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ABSTRACT

This methodology was developed to obtain sound population and industrial projections for Tennessee, but should be applicable for any small area. The large volume of data required the use of computers, and the nine programs are reproduced in full. The methodology is designed to point out manpower problems which would arise in a region if the demographic trends of the base periods are continued to the projection dates. Included in the computer programs are: (1) an employment projection program, (2) population and labor force projection programs, (3) an industry projection program, and (4) an occupational program. The related study for which this methodology was developed is available as VT 011 976 in this issue. (Author/JS)

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PROJECTION TECHNIQUES FOR MANPOWER PLANNING IN SMALL AREAS

by

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assisted by

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OUTLINE OF THE TENNESSEE POPULATION AND ECONOMIC BASE STUDY

I. TENNESSEE AS AN ECONOMIC ENTITY

II. TENNESSEE AND NATIONAL ECONOMIC GROWTH

III. TENNESSEE POPULATION, LABOR FORCE AND EMPLOYMENT

  A. PROJECTION TECHNIQUES FOR MANPOWER PLANNING IN SMALL AREAS ← This Study

  B. TENNESSEE POPULATION, LABOR FORCE, AND EMPLOYMENT PROJECTIONS AND INTERPRETATIONS

IV. TENNESSEE LARGE URBAN AREAS

V. TENNESSEE INDUSTRY

VI. TENNESSEE RESOURCES

VII. TENNESSEE SERVICES

VIII. ECONOMIC PROFILES OF TENNESSEE'S NINE PLANNING REGIONS

IX. POLICY CONCLUSIONS

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FOREWORD AND ACKNOWLEDGEMENTS

The Tennessee State Plan, like any other socio-economic plan of its kind, had to be based on sound and reliable projections of the major relevant characteristics of population, labor force and employment. It was deemed necessary to adapt and supplement available statistical techniques in order to achieve the following ends simultaneously: 1) comparability and consistency among the different projections, 2) sufficient variety of techniques to suit the widely differing social and economic conditions of the ninety-five Tennessee counties, 3) computational simplicity to make computer programing relatively simple and 4) obtaining the most meaningful information for practical policy-making in the field of manpower planning. The present volume is the result of these efforts. The usefulness of the methodology and computer program described in the following pages is believed to go beyond the formulation of the present Tennessee State Plan. As indicated in the title, the techniques described here are believed to be of use to any state, organization, group or individual interested in making projections of major characteristics of population, manpower and employment for small areas for the purpose of manpower planning. It is for this reason that this methodology is published in a separate volume.

Riad B. Tabbarah, presently social affairs officer at the United Nations, developed the basic methodology and wrote this volume. C. Howard Davis, then of the economic staff of the State Planning Office, and Craig Kennerly were mainly responsible for developing the computer program described in the appendix. Leo T. Surla, Jr. and Salim A. Kublawi, then of the economic staff of the State Planning Office, collaborated in, and contributed to, most stages of the present work. I would like to take this opportunity to congratulate all of them on a job well done.

Linzy D. Albert
Director
State Planning Office

INTRODUCTION

The second volume of the Population and Manpower Projections Section of the Tennessee Population and Economic Base Study describes the means for making the population and industrial projections for Tennessee which were interpreted in the first volume. The first volume was devoted to the presentation and interpretation of the projections for Tennessee; this volume is devoted to an explanation of the methodologies and calculations used in the making of these projections.

This volume is divided into two parts. The first part is a detailed statement of the methodology of the projections. The second part contains reproductions of each of the nine computer programs employed in the making of these projections. The large volume of data in these projections required the use of computers. Accompanying each program is a detailed explanation of each step in the program. This part will be of special interest to programmers and others who wish to use this methodology for their own regions.

The methodology is designed to point out manpower problems which would arise in a region if the demographic trends of the base period are continued to the projection dates.[1] Some examples of the problems that would be uncovered by the projections would be high out-migration, large increases in the youngest and oldest age groups in the population accompanied by a decline in the number of people in the productive age groups, increasing dependence of a region upon one particular industry for its economic base, and high dominance of females among total employment within the region. These problems sometimes appear as absurdities (an example would be more than half the total projected employment in a county or region in one industry group due to a sharp increase in employment in this industry group during the base period).

A brief summary of the manpower data which is provided by these projections is in order. The programs are divided into two groups, the population and labor force group and the industrial and occupational group. These groupings are explained in the flow chart of the programs which will be presented with the programs sections. The employment projections project employment by county for agricultural and non-agricultural sectors.

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[1] In Tennessee, the base period for these projections was the 1950-1960 period, with projections made for 1970 and 1980.

The population and labor force projections forecast the age-sex compositions of both the population and labor force, plus the labor force participation rates for each age-sex group used in labor force calculations. Some additional information generated by these projections are the migration rate adjustment factors for the total population, the projected employment rate for the total labor force (which must be between 90 and 96 percent), plus the discount rate and the migration rate for each age-sex group in the population (and color groups, where non-white populations are projected separately) Another program accumulates the population data projected by county so as to accumulate population data for a multi-county region.

The industrial and occupational projections group projects employment by sex for each of 17 industry groups. The absolute numbers employed by sex for each industry are projected. The relative distribution of employment by each sex by industry group and the relative distribution within each industry group such as (the percentage of males in the total employment in a certain group) are also projected. The relative distribution of males and females as a percentage of total employment are also projected. The occupational projections project employment within each of nine occupational groups and employment in these occupation groups by industry. Again, there are accumulations programs designed to make projections of these industrial and occupational data for multi-county regions.

Some of the things that these projections can show for regions are what changes can be expected to occur in the population and the labor force if the trends of the base period continue. It will show, for example, the projected percentage of the labor force that will be male, as well as the projected number of jobs for males that will be generated in the region. It can then show whether there will be an excess or a shortage of male employment in the region.[2] The projections can show which industries can be expected to become the largest employers in the region. The largest occupations in the region can also be forecast. This information is especially important in planning the types of curriculums to be offered by educational systems, especially vocational training schools It can be seen whether growth in certain occupations is the result of relatively greater hiring of workers in these occupations by all the industries within the area, or if the growth in these occupations is the result of relatively greater growth of industries which hire harge numbers of workers in the occupation.

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[2] A shortage of available workers of one sex causes an excess of available workers of the other sex, because of the link between total population and total employment assumed in the methodology.

The projections, of course, did similar things for the State of Tennessee. The projections forecast large gains in certain industries which pay relatively low wages. This trend, if continued until 1980, would make it difficult for Tennessee to catch up to the national average in per capital income. The projections also showed that there would be many more jobs for females than there would be females available for work. This suggests a serious shortage of female labor and an excess of male labor. These projections portend serious sociological problems ahead for Tennessee. On the brighter side, the projections foresee a faster rate of population growth in the State in the 1960-1970 period than prevailed during the 1950-1960 period, with a sharp slowdown of population growth rate in the 1970-1980 period. This suggests improved employment opportunities in Tennessee during the coming years. These figures were the result of continuations of the trends that occurred during the 1950-1960 base period. Independently produced evidence suggests that employment and population growth in Tennessee has exceeded the projections. This is an indication that Tennessee's economy has shown definite improvement in the 1960-1966 period. Here, the projections can be compared with projections based on extrapolations of other economic data developed for areas to show whether or not the economy of a region is showing improvement in recent times over the state of that economy during the base period.

These projections occupy an important place in the Tennessee Population and Economic Base Study. The projections interpretations outline the manpower problems in Tennessee that were revealed by the programs and suggest some solutions for them. The projections, combined with other data concerning the Tennessee economy as it has developed during the early 1960's, serve as the basis for manpower planning in Tennessee. This manpower planning, broadly defined, can expand to include almost all economic planning carried on in the State; since economic planning is designed to benefit people. Therefore, it occupies an important place in the Base Study. It is tentatively planned to be Chapter III of the base study, preceding the chapter of Tennessee Large Urban Areas and following the chapter on Tennessee and National Economic Growth.

PROJECTION METHODOLOGY

A basic assumption underlying the present methodology is that, in a small open area, it is more reasonable to assume that the size of the population tends, given a certain range of unemployment, to adjust to the level of employment rather than vice versa. In other words, since, in the counties, the production in the main economic activities - especially in non-agricultural pursuits - is generally largely destined to areas outside the county limits (and often outside the State), a rise or decline in a county's surplus population does not have, in the short run, at least, a very significant effect on the general level of production and employment. On the other hand, since labor mobility is presumably high, any significant maladjustment between a county's labor supply and employment opportunities tends to be corrected, after some shift in unemployment levels, by a change in the rate of population growth, mainly through a change in migration rates. Consequently, projected employment at the end of the period may, in such small areas, be taken as the basic determinant of the rate of migration during the period and, hence, of the size of the population at the end of the period.

Projection of Employment

The first step was, therefore, to project employment to 1970. After experimenting with a number of projection methods, the results for a selected number of counties indicated that separate projections for agricultural and non-agricultural employment were necessary, since the trends of these two components were generally moving in opposite directions and, at the same time, the proportion of agricultural employment, in practically all counties, was rapidly approaching a very low level comparable to that obtained in the nation. Consequently, it was found that, in most counties, the 1950-60 rate of growth of employment was lower than would otherwise be (or even negative) because the rise in non-agricultural employment was dampened (or overbalanced) by the sharp decline in agricultural employment. In most instances, it was also found that, by 1960, agricultural employment had already reached such a low proportion of total employment that the potential effect of a further decline in this proportion on the trend of total employment could only be of little significance. In these cases, the future trend in total employment was found to be largely determined by the past trend of non-agricultural employment and not total employment.

The separate projection of agricultural and non-agricultural employment was therefore necessary in these circumstances.[1]

A brief example will help clarify this point:

Suppose that:

	1950	1960
Agricultural Employment	100	50
Non-Agricultural Employment	200	250
Total Employment	300	300

In this instance, if total employment is projected linearly (i.e. geometrically) to 1970, the result would be 300 or constant employment as in the 1950-60 period. However, if agricultural and non-agricultural employment are projected separately we obtain 25 and 313 respectively, i.e., a total for 1970 of 338. It is obvious that employment remained steady in the 1950-60 period because the fall in agricultural employment compensated for the rise in non-agricultural employment. By 1960, however, the level of non-agricultural employment became relatively so small that the effect of its decline on total employment has become much less significant. From that point on, the trend in total employment is mainly determined by the trend in non-agricultural employment.

With this in mind, two basic methods were followed in projecting employment by county. Following both methods, agricultural employment was projected from 1960 to 1970 with the use of the yearly rate of change implied by the 1950 and 1960 relevant census data.[2] The two methods differed in that non-agricultural employment was projected arithmetically following the first method and geometrically following the second method.[3] Because non-agricultural employment is generally rising, the second method gave consistently higher estimates of 1970 employment than the first method. However, for more than two-thirds of the counties (including the metropolitan areas and the more populous counties),[4] the difference between the two projections was less than 10 per cent. In these cases the results of the second method were taken as final. For the remaining counties the 1970 estimate taken as final was that which proved to be closest to the result of a third estimate of 1970 employment made on the basis of a third method following which agricultural employment was projected as in the two previous methods but where non-agricultural employment of the 1960 census was projected on the basis of the arithmetic trend of the yearly covered employment data of the period 1956 to 1964.[5]

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[1] Further breakdown of total employment was, of course, possible but was not undertaken because there was no reason to believe that by doing so the quality of the estimates would be significantly improved.

[2] Since agricultural employment is generally falling, the use of a constant rate (i.e., of geometric projection) rather than a constant magnitude (i.e., of arithmetic projection) resulted in the desirable situation where no negative agricultural employment projections could be obtained but only ones that follow a trend which becomes asymptotic to zero in the distant future.

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[3] It must be noted that the main weakness of these two methods derives from the fact that the trend used in projecting employment was derived from only two past observations (1950 and 1960 census data). This, in fact, is another reason for using a third method, which will be referred to strictly as a general benchmark.

[4] i.e., the upper 25 per cent of all counties as determined by their employment levels in 1960.

[5] The logic behind the use of this method as the basis for choice between the results of the first and second methods is the following: it was initially decided to use the more optimistic results of the second method except where there is a strong indication that these results are too optimistic (i.e. unrealistic). Since the trend of covered employment tends to somewhat overstate the growth in non-agricultural employment mainly because of the continuous transformation of small non-covered firms into larger covered firms and the smaller incidence of withdrawal of large covered firms, a projection of non-agricultural employment on the basis of this trend which is none the less significantly lower than that made on the basis of the second method was taken as a "strong indication" that the results of the latter method were "too optimistic". There were, therefore, dropped and the results of the first method used instead.

By applying this principle the final projection for about two thirds of the remaining counties was found to be that obtained by the second method while only one third that obtained by the first method. All in all, therefore, employment for 84 counties was projected following the second method and for 11 following the first method.

Projection of Population and Labor Force by Age and Sex

Once the employment level for 1970 was determined for a county, a projection of population by sex, age, and color was undertaken assuming sex-age-color fertility, mortality and migration trends of the 1950's to be applicable to the 1960's.[6] The labor force was then projected by sex and age to 1970 by applying projected sex-age participation rates to the corresponding sex-age groups of the population.[7]

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[6] This method is described in detail in U. S. Department of State, Agency for International Development, *Demographic Techniques for Manpower Planning in Developing Counties*, Washington, 1963, pp. 108-113.

[7] The projection of sex-age participation rates to 1970 presented a problem because the 1950 population census did not give these rates for the counties. Therefore, the 1950-60 relative change in male age participation rates for the state and the absolute change in female age participation rates were used to project the corresponding 1960 county rates of the counties. The reason why the relative change was used for males and the absolute change was used for females is that, for the former, participation rates are generally falling while for the latter they are always rising. Consequently, the use of *relative* change for male rates tends to minimize the magnitude of the fall in counties where the 1960 participation rates are already low and increase it where they are relatively high. On the other hand, the use of the *absolute* change for female rates tends to minimize the relative increase in female participation where the 1960 rates are already high and magnify it where 1960 rates are low.

From the resulting labor force was then subtracted the projected employment and an unemployment rate was then obtained.

Six different situations were then distinguished, three relating to inmigration counties and three to outmigration counties. Situation 1: Inmigration county with unemployment rate between 3 and 10 per cent. If the unemployment rate was found to be between 3 and 10 per cent, the population and labor force projections, as well as the employment projection, were accepted as final and similar computations begun for the next county.

Situation 2: Inmigration county with unemployment rate higher than 10 per cent. This situation meant that if 1950-60 inmigration rates continue through the 1960's, employment opportunities would, by 1970, be relatively too few to absorb even 90 per cent of the labor force. Thus a new projection of population was undertaken which assumed 1960-70 sex-age migration rates to fall to 0.75 of the 1950-60 levels. If the resulting labor force still implied an unemployment rate higher than 10 per cent, a third population projection using 0.50 of the 1950-60 migration rates was undertaken and so on using 0.25, 0, - 0.25 (making the county an outmigration county) etc. until the unemployment rate reached a level between 3 and 10 per cent. The corresponding population and labor force projections were then considered final.

Situation 3: Inmigration county with unemployment rate lower than 3 per cent. This situation meant that if the 1950-60 inmigration rates were to continue to 1970, the labor force in that year would be too small to fill all job vacancies (allowing for a minimum of 3 per cent unemployment rate). Consequently, population was projected anew under the assumption of increasing inmigration, namely, by multiplying sex-age migration rates by 1.25, 1.50, 1.75 etc. until an unemployment rate of between 3 and 10 per cent was obtained. The corresponding population and labor force projections were then considered final.

Situation 4: Outmigration county with unemployment rate between 3 and 10 per cent. Same as situation 1 above.

Situation 5: Outmigration county with unemployment rate lower than 3 per cent. This situation meant that the expected employment level in 1970 would not justify outmigration rates during the 1960's that are as high as those of the 1950's. Consequently, a new projection of population was undertaken which assumed 1960-70 sex-age migration rates to fall to 0.75, 0.50, 0.25 etc. as in situation 2 above.

Situation 6: Outmigration county with unemployment rate higher than 10 per cent. This situation, finally, meant that past rates of outmigration from the county would not be sufficiently high to bring about a reasonable relationship between the labor force and the limited employment opportunities by 1970. Therefore, new projections of population were undertaken in which the 1960-70 sex-age migration rates were assumed to rise to 1.25, 1.50, 1.75 etc. (as in situation 3 above) times those of 1950-60 until an unemployment rate of between 4 and 10 per cent was obtained. Here again, the corresponding population and labor force projections were then considered final.[8]

In order to allow for a certain degree of unreliability of basic data (and, of course, methodological weaknesses), situation 1 may be made to include counties that would otherwise be classified under situations 2 or 3, but for which the accepted (i.e., final) population projection assumed a change of only 25 per cent or less in past sex-age migration rates (i.e., inmigration counties in situations 2 and 3 where projected migration rates were 0.75 or 1.25 of the 1950-60 rates). Similarly, situation 4 may be made to include counties that would otherwise be classified under situations 5 and 6, but for which the accepted population projection assumed a change in past migration rates of only 25 per cent or less. The following table gives the number of Tennessee counties in each of the six different situations as obtained in a preliminary run of the data:

	Total inmigration counties	9[9]
Situation 1:	Inmigration expected to remain substantially unchanged	4
Situation 2:	Inmigration expected to decrease significantly	3
Situation 3:	Inmigration expected to increase significantly	2
	Total outmigration counties	86[9]
Situation 4:	Outmigration expected to remain substantially unchanged	34
Situation 5:	Outmigration expected to decrease significantly	50[10]
Situation 6:	Outmigration expected to increase significantly	2

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[8] For some counties, in situations 2, 3, 5 and 6, the .25 change in sex-age migration rates resulted in changing the unemployment rate from less than 3 per cent to more than 10 per cent or vice versa. In these situations a .10 change in sex-age migration rates was used.

[9] On the basis of 1950-60 period.

[10] Two of these outmigration counties are expected to become inmigration counties by 1970.

From the point of view of over-all manpower supply and demand, the problem, if any, in counties in situations 1 and 4 is expected to remain generally the same as in the past decade. Unless specific information to the contrary is obtained, the populations in these counties may be expected to continue to adjust smoothly, through migration, to the levels and trends of employment. This does not, however, mean that these counties will not experience any serious over-all demographic and manpower problems. Counties in this situation which are experiencing heavy outmigration are indeed "problem counties" where serious efforts at rapid economic expansion are necessary if outmigration is to be halted or significantly reduced. These problems, however, are not new and are carried over from past years.

Situations 2 and 6 are indicative of forthcoming pressures of overabundance of manpower in relation to employment opportunities. Labor surplus situations may, therefore, arise--in the former counties because the necessary decrease in inmigration rates may not be forthcoming at the proper time and in the latter counties because the necessary increase in outmigration rates may materialize only after a certain critical delay.

Situations 3 and 5, finally, are, theoretically at least, both potential labor shortage situations. In practice, however, experience shows that such shortages are more likely to materialize in the former counties than in the latter ones: the availability of job opportunities may be slow in drawing labor from outside the county (situation 3), while an employed person is not very likely to outmigrate (situation 5). Thus, there is greater likelihood that migration rates will adjust more rapidly and smoothly in the latter case than in the former.

It must be warned that the projections obtained with this method do not necessarily describe the situation at the end of the period--nor are they intended to do so. Beside errors in statistics and defects inherent in this, or any other, methodology;the projections assume that, among other things, employment trends in the 1960's will be similar to those reported for 1950-60. The projections of population and labor force as well as of employment will be off the mark where the employment trends of this decade vary greatly from those of the previous one. If this were not true, the projections would imply that nothing could be done to improve the situation in depressed counties and areas of the State. In fact, the main purpose of the projections is actually to point out counties and areas where demographic and manpower problems are likely to arise or increase unless something is done about them. In other words, what we are saying here is this: "If economic expansion (or contraction), in terms of job opportunities, in a given county proceeds at past rates such and such demographic and manpower problems are likely to arise." It is then the function of public and private institutions to attempt to modify the rate of economic expansion - for example, by finding ways of attracting industry to expand the rate of growth of job opportunities - in a way that would solve these problems before a critical stage is reached. Indeed, this is, in one way or another, the main function of manpower planning.

Projection of Employment by Industry and Occupation

The techniques described in the previous sections are used to obtain, in addition to expected population movements, an idea of imminent situations of over-all manpower shortages and surpluses in given counties and the State. The techniques described in this section are intended for use in determining industries which will be the major source of demand for manpower and the manpower skills that are likely to be most in demand. One of the basic set of data required for adequate manpower planning is, therefore, the future distribution of employment by industry and by skill or occupation. A comparison between the projected distribution of employment by industry and the corresponding distribution at the base period gives the likely magnitude of the growth of employment by industry and thus indicates the industries which will be mostly responsible for the growth in the demand for labor. On the other hand, the comparison of projected distribution by occupation with the same distribution at the base period gives the likely magnitude of the growth of employment by occupation and hence the fastest growing skills and the skills for which demand will be greatest. Finally, if a projection of the expected supply of manpower by occupation is obtained (techniques for doing this are not explained in this manual) it may be compared with the projected distribution to obtain an indication of imminent shortages and surpluses of the state.

a. Projection of Employment

The first step made in undertaking the above projections was to project employment by projecting agricultural and non-agricultural employment separately as done in Worksheet I. The example chosen for illustration is the State[11] and the 1970 projections resulted in:

Agricultural Employment ----------	70,894
Non-agricultural Employment ------	1,338,386
Total Employment (1970) ----------	1,409,280

It may be noted here that, since data for the state may be reliably obtained from other sources than the census (e.g. Employment Security), it may be possible to make a more reliable projection than the one made above. The above projection, however, is made for illustrative purposes and, as will be seen, may be changed without affecting the techniques described later in this section.

b. Projection of the Distribution of Non-Agricultural Employment

Since agricultural employment was projected separately, an estimate of future employment in that sector has been obtained. The task now is to distribute the projected non-agricultural employment among the different non-agricultural sectors. The sectors chosen for illustration are those shown in Worksheet V. Obviously, a finer breakdown may be used, if data are available, without affecting the methodology. The step by step calculations are appended to Worksheet V. The method used is a ratio method using straight-line extrapolation to 1970 by sector or industry, of the relative distribution of non-agricultural employment in 1950 and 1960. The relative distribution thus obtained was then forced to equal 100 percent and the resulting ratios applied to the projected total non-agricultural employment (step "a" above), namely, 1,338,386.

c. Projection of the Occupational Distribution of Employment

The change in the occupational distribution of employment is generally due to two major factors -- the changes in the relative distribution of employment by industry (i.e., the relative growth of different industries) and the changing occupational distribution within industries. For example, an increase in the ratio of clerical workers to total employment may be due to the fact that "business and repair services" which employ the bulk of the clerical workers have grown, in terms of employment, faster than other industrial activities that employ less clerical workers (relative growth of industry) and/or to the fact that certain industries, say "trade," are now employing relatively more clerks than before (changing occupational distribution within industries). The relative growth of different industries to 1970 has already been calculated in Worksheet V. (For agriculture see section "a" above). It remains to estimate the future occupational distribution by industry (including agriculture). This is done in Worksheet VI. The projection of employment by occupation is undertaken in Worksheet VII which, as explained above, is a combination of the results obtained in the two previous Worksheets.

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[11] The data were obtained from Table 30 of the 1950 U. S. Census and Table 61 of the 1960 U. S. Census.

The Worksheets

WORKSHEET I

LOUDON COUNTY

Employment Projection to 1970

Sector (1)	1950 (Census)[1] (2)	1960 (Census)[2] (3)	Trend Multiplier (Method 1) (4)
Ag. Empl.[3]	1,746	865	x 0.4954
No. Ag. Empl.	5,886	7,251	+ 1365
Total	7,632	8,116	

Sector	Trend Multiplier (Method 2) (5)	1970 (Method 1) (6)	1970 (Method 2) (7)
Ag. Empl.[3]	x 0.4954	429	429
Non. Ag. Empl.	x 1.232	8,616	8,933
Total		9,045	9,362

Method 3 = 14141

[1] Table 43

[2] Table 85

[3] Agriculture, forestry, and fisheries

Instructions for Completing Worksheet I:

Column (1): List sectors corresponding to components of employment for which separate projections are being made.

Column (2): Opposite each sector list numbers employed from 1950 census.

Column (3): Opposite each sector list number employed from 1960 census.

Column (4): In first row place result of division of (3) by (2). In second row place the result of (3) - (2). Leave third row empty.

Column (5): For first and second rows same as for first row of column (4). Leave third row empty.

Column (6): First row: (3) x (4). Second row: (3) + (4). Third row: total first and second row.

Column (7): First and second row as first row in column (6). Third row: total first and second row.

WORKSHEET IIa

LOUDON COUNTY

Population Projection to 1970 (constant migration)

MALE

Age Group (1)	Population 1950[1] (2)	Population 1960[2] (3)	Discount Ratios (4)	Pop. 1970 (5)	Life Table Survival Ratios[3] (6)	Migration Rates (7)
0-4	1,425	1,213	.906	1083	.978	- .072
5-9	1,273	1,217	.827	1087	.969	- .142
10-14	1,223	1,291	.574	1099	.967	- .393
15-19	1,072	1,053	.617	1006	.963	- .346
20-24	834	702	.853	741	.956	- .103
25-29	877	661	.884	650	.948	- .064
30-34	823	711	.896	599	941	- .045
35-39	819	775	.877	584	.932	- .055
40-44	684	786	.885	637	.917	- 032
45-49	595	718	.906	680	.894	+ 012
50-54	559	605	.773	696	.855	- .082
55-59	435	539	.805	651	.798	+ .007
60-64	349	432	.811	468	.717	+ .094
65-69	301)	350)		434		
70-74	213) 710	283) 924	.410	350	.681	- .271
75 +	196)	291)		379		
				(11,144)		

[1] Census Table 41

[2] Census Table 27

[3] Latest Life Table

WORKSHEET IIb
LOUDON COUNTY

Population Projection to 1970 (constant migration)
Female

Age Group	Population				Discount Ratio	Pop. 1970		Life Table Survival Ratios	Migration Rates
	1950		1960						
(1)	(2)		(3)		(4)	(5)		(6)	(7)
0-4	1,289		1,159		.961	1035		.983	- .022
5-9	1,175		1,182		.850	1056		.976	- .126
10-14	1,092		1,239		.621	1114		.975	- .354
15-19	1,015		999)	4,647	.638	1005)	4,151	.973	- .335
20-24	908		678)		.774	769)		.970	- .196
25-29	914		648)		.892	637)		.967	- .075
30-34	887		703)		.906	525)		.963	- .057
35-39	836		815)		.941	578)		.958	- .017
40-44	712		804)		.993	637)		.949	+ .044
45-49	598		787		1.052	767		.936	+ .116
50-54	563		707		.913	798		.916	- .003
55-59	429		629		1.044	828		.886	+ .158
60-64	344		514		1.038	645		.843	+ .195
65-69	311)	742	448)	1084		657			
70-74	219)		357)		.376	534		.776	- .400
75+	212)		279)			408			
						(11,993)			

Total population 1970 (worksheets IIa and IIb) = 11,144 + 11,993 = 23,137

Instructions for Completing Worksheets IIa and IIb

Column (1): List age groups in 5-year age brackets ending with 75 and over (75+). Add a row for total.

Column (2): Opposite each age group in column (1), list the number in the population as reported in 1950 census.

Column (3): Opposite each age group in column (1), list the number in the population as reported in 1960 census.

Column (4): Starting with the third row, divide each number in column (3) by the number for the age group 10 years younger in column (2) and place the result in the same row as the column (2) divisor. For example, for the 1960 "10-14" age group, divide their number (1,291) in column (3) by the number (1,425) in column (2) corresponding is age group "0-4" (i.e. no years younger) and place the result (.906) in the row corresponding to age group "0-4" (i.e. first row) of column (4). For the last row of column (3), divide by the total of the last three rows of column (2) and place in next to last row.

Column (5): For each row multiply (3) by (4) and place in column (5) two rows below. For example, the third row in column (5), i.e. 1099 is obtained by multiplying the first row of column (3), i.e. 1,213 by the same row of column (4), i.e., .906. The last row in column (5) is obtained by multiplying the total of the last three rows (924) of column (3) by the last figure (.410) of column (4) to obtain 379. The total of column (5) is started at the bottom of that column between parenthesis. Note that so far the first two rows of column (5) remain empty. The values in them should be obtained as follows: 1. Divide the figure in each of these two rows in column (3) by the total of rows (4) through (9) of column (3) of Worksheet IIb. 2. Multiply the results by the total of rows 4 through 9 of column (5) of Worksheet IIb and place the results in the appropriate rows.

Column (6): List for each age group the 10-year survival ratio from the latest life table for the state, since no life tables for counties are available. (These ratios are obtained by dividing each age group by the age group 10 years younger for the Lx functions of the life table, the result being the 10-year survival ratio of the younger age group).

Column (7): For each row: (4) - (6).

Note that columns (6) and (7) are not necessary except for counties which show an unemployment rate not between 3 and 10 percent after completing worksheet IIIb

WORKSHEET IIIa
LOUDON COUNTY

Projection of Labor Force to 1970 (constant migration)
Male

Age Group (1)	Pop. 1960 1/ (2)	Labor Force 1960 2/ (3)	Participation Rates 1960 (4)	Projection Factor (5)	Participation Rates 1970 (6)	Pop. 1970 (7)	Labor Force 1970 (8)
14-17	949	155	.163	.767	.125	847	106
18-24	1,039	734	.706	.972	.686	1,117	766
25-34	1,372	1,224	.892	1.037	.925	1,249	1,144
35-44	1,561	1,589	1.000	1.000	1.000	1,221	1,221
45-64	2,294	1,894	.826	.987	.815	2,495	2,033
65+	924	295	.319	.692	.221	1,163	257
							(5,538

1/ Census Table 27

2/ Census Table 83

WORKSHEET IIIb
LOUDON COUNTY

Projection of Labor Force to 1970 (constant migration)
Female

Age Group (1)	Pop. 1960[1/] (2)	Labor Force 1960[2/] (3)	Participation Rates 1960 (4)	Projection Factor (5)	Participation Rates 1970 (6)	Pop. 1970 (7)	Labor Force 1970 (8)
14-17	912	62	.068	+ .002	.070	817	57
18-24	1,046	504	.482	+ .078	.560	1,191	667
25-34	1,578	581	.368	+ .086	.454	1,162	528
35-44	1,656	758	.458	+ .098	.556	1,215	676
45-64	2,449	808	.330	+ .120	.450	3,038	1,367
65+	1,099	53	.048	+ .026	.074	1,599	118
							(3,413)

Total labor force (worksheet IIIa and IIIb) = 5538 + 3413 = 8951

Total employment (worksheet I) = 9362

Unemployment rate $= 1 - \frac{9362}{8951} = -.05$ or - 5 % < 3%.

Instructions for Completing Worksheets IIIa and IIIb

Column (1): List age brackets as indicated.

Column (2): List corresponding population from 1960 census.

Column (3): List corresponding labor force from 1960 census.

Column (4): For each row: (3) ÷ (2). Obviously, the maximum rate here could not be larger than 1.000. This is why the figure in row 4 is made equal to 1.000.

Column (5): This column reflects the 1950-1960 trend of sex-age participation rates in the state. The reason for the use of state rather than the county data is that the latter data for 1950 were not readily available. Here, and in this manual as a rule, extrapolation of percentages were made linearly. For rising trends arithmetic projection was used (i.e., 1970 percentage is equal to that of 1960 plus the percentage point difference between the 1960 and 1950 percentages). For declining trends, geometric projection was used (i.e. 1970 percentage is equal to 1960 multiplied by the ratio of the 1960 to the 1960 percentage). Since in this instance the trend of female participation rates for the state was rising and that of males was falling (or constant), the first method was used in obtaining female projection factor while the second method was used in obtaining male projection factors.

Column (6): In Worksheet IIIa, for each row mulitply (4) by (5). In Worksheet IIIb add (4) + (5).

Column (7): From Worksheets IIa and IIb, column (5), list numbers in each age group. For the odd age brackets of the first two rows see Worksheets IIIa/$_1$ and IIIb/$_1$.

Column (8): For each row: (6) x (7). The total is indicated at bottom of column between parentheses.

WORKSHEET IIIa/1
LOUDON COUNTY

Derivation of Ages 14-17 and 18-24
From 5-year Age Groups (1970)
Male

Age Group (1)	Pop. 1970 (2)	Sprague Multipliers[1] (3)	Age 14 (4)	Age 19 (5)	Sprague Multiplier (6)	Age 18 (7)
0-4	1083	+ .0016	+ 1.7	--	--	--
5-9	1087	- .0240	- 26.1	+ 1.7	+ .0064	+ 7.0
10-14	1099	+ .1504	+165.3	- 26.4	- .0416	- 45.7
15-19	1006	+ .0848	+ 85.3	+151.3	+ .2224	+223.7
20-24	741	- .0128	- 9.5	+ 62.8	+ .0144	+ 10.7
25-29	650			- 8.3	- .0016	- 1.0
Total			216.7	181.1		194.7

14-17 = 847
18-24 = 1117

---

[1] The Sprague multiplier is a method of deriving population in single-year ages (an example is 14 years) within a given five-year age group from the populations in that and certain other five-year age groups. The Sprague multipliers are used in this program to determine the number of people 14, 18 and 19 years of age for the purpose of projecting the labor force. The reason for the use of Sprague multipliers is that the two youngest age groups in the labor force calculations (14-17 years and 18-24 years) do not coincide with the five-year age groups used in population calculations. The multipliers are used to estimate the population in the 14-17 and the 18-24 year age groups. These populations are then divided by the labor force figures in these groups to obtain labor force participation rates.

The Sprague multipliers used in these programs are given in the worksheets, and can be readily inserted into the input data.

WORKSHEET IIIb/1
LOUDON COUNTY

Derivation of ages 14-17 and 18-24 From 5-year Age Groups (1970)
Female

Age Group (1)	Pop. 1970 (2)	Sprague Multipliers (3)	Age 14 (4)	Age 19 (5)	Sprague Multipliers (6)	Age 18 (7)
0-4	1035	+ .0016	+ 16.6	--	--	--
5-9	1056	- .0240	- 25.3	+ 1.7	+ .0064	+ 6.8
10-14	1114	+ .1504	+ 167.5	- 26.7	- .0416	- 1.8
15-19	1005	+ .0848	+ 85.2	+151.2	+ .2224	+ 223.5
20-24	769	- .0128	- 9.8	+ 65.2	+ .0144	+ 11.1
25-29	637			- 8.2	- .0016	- 1.0
Total			234.2	183.2		238.6

14-17 = 817
18-24 = 1191

Instructions for Completing Worksheets IIIa/1 and IIIb/1[1]

Column (1): List 5-year age brackets to 29 years.

Column (2): List corresponding 1970 population from worksheets IIa and IIb.

Column (3): From a table of Sprague Multipliers list the row n5 of the mid-panel.

Column (4): For each row: (2) x (3).

Column (5): For each row, starting with the second row, multiply (2) by (3) one row above. For example, for the second row + 1.7 is obtained by multiplying 1,087 of column (2) by +.0016 of column (3).

Column (6): Starting with second row, list Sprague Multiplier obtained from row n4 of mid-panel.

Column (7): For each row: (2) x (6).

14-17 = 14 (column 4) + 15-19 (column 2) - 18 (column 7) - 19 (column 5).
18-24 = 18 (column 7) + 19 (column 5) + 20-24 (column 2)

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[1] For readers unfamiliar with the use of the Sprague Multiplier it may be advisable to consult another manual by the author entitled Demographic Techniques for Manpower Planning in Developing Countries, op. cit., p. 114ff.

Unemployment Rate

1. Total employment, 1970, may be obtained from Worksheet I (9,362)

2. Total labor force may be obtained from Worksheets IIIa and IIIb (5538 + 3413 = 8951)

3. Unemployment Rate = $1 - \frac{\text{Employment}}{\text{Labor Force}} = 1 - \frac{9362}{8951} = -5\%$.

Since the unemployment rate is less than 3% and Loudon County is an outmigration county (see situation 5, in section 3 entitled Projection of Population and Labor Force by Age and Sex) the projection procedure should be repeated assuming migration rates for 1960-1970 to be 3/4 of those for 1950-60. All computations are therefore the same except for the discount ratios used in Worksheets IIa and IIb. To obtain the new discount ratios proceed as in Worksheets IVa and IVb. Once these are obtained substitute them in column (4) of Worksheets IIa and IIb and proceed as before through all remaining Worksheets. This process should be continued until the unemployment rate is found to be between 3 and 10 percent.

WORKSHEET IVa
LOUDON COUNTY

Population Projection to 1970
(Mig. 1960-70: .75 Mig. 1950-60)
Male

Age Group (1)	Migration Rates 1950-1960 (2)	Migration Rates 1960-1970 (3)	Life Table Survival Ratios (4)	Adjusted Discount Ratios (5)
0-4	- .072	- .054	.978	.924
5-9	- .142	- .107	.969	.862
10-14	- .393	- .295	.967	.672
15-19	- .346	- .260	.963	.703
20-24	- .103	- .077	.956	.879
25-29	- .046	- .048	.948	.900
30-34	- .045	- .034	.941	.907
35-39	- .055	- .041	.932	.891
40-44	- .032	- .024	.917	.893
45-49	+ .012	+ .015	.894	.909
50-54	- .082	- .062	.855	.793
55-59	+ .007	+ .009	.798	.807
60-64	+ .093	+ .116	.717	.833
65-69				
70-74	- .271	- .203	.681	.478
75+				
Total				

WORKSHEET IVb
LOUDON COUNTY

Population Projection to 1970
(Mig. 1960-70 = .75 Mig. 1950-60)
Female

Age Group (1)	Migration Rates 1950-60 (2)	Migration Rates 1960-70 (3)	Life Table Survival Ratios (4)	Adjusted Discount Ratios (5)
0-4	- .022	- .017	.983	.966
5-9	- .126	- .095	.976	.881
10-14	- .354	- .266	.975	.709
15-19	- .335	- .251	.973	.722
20-24	- .196	- .147	.970	.823
25-29	- .075	- .056	.967	.911
30-34	- .057	- .043	.963	.920
35-39	- .017	- .013	.958	.945
40-44	+ .044	+ .055	.949	1.004
45-49	+ .116	+ .145	.936	1.081
50-54	- .003	- .002	.916	.914
55-59	+ .158	+ .198	.886	1.084
60-64	+ .195	+ .244	.843	1.087
65-69				
70-74	- .400	- .300	.776	.476
75+				

Instructions for Completing Worksheets IVa and IVb

Column (1): List 5-year age brackets as indicated

Column (2): List corresponding migration rates from column (7) of Worksheets IIa and IIb.

Column (3): For each row with minus sign: (2) x 0.75; for each row with plus sign: (2) x 1.25.

Column (4): Same as column (6) of Worksheets IIa and IIb.

Column (5): For each row: (3) + (4).

WORKSHEET V
TENNESSEE

Projection of Distribution of Non-Agricultural Employment by Industry

Industry[3] (1)	Employment 1950[1] % (2)	1960[2] % (3)	1970 % (4)	1970 (forced to 100% (5)	1970 (6)
Mining	1.7	.8	.4	.4	5,354
Construction	9.2	7.9	6.8	6.6	88,334
Manufacturing	27.7	30.3	33.1	32.4	433,637
Transport., Communica. etc.	8.8	7.4	6.2	6.1	81,642
Trade	22.3	20.8	19.4	19.0	254,293
Finance, Ins., etc.	3.0	3.8	4.8	4.7	62,904
Business & repair Ser.	2.7	2.7	2.7	2.6	34,798
Personal Services	9.6	8.9	8.3	8.1	108,409
Entertainment, etc.	.9	.7	.5	.5	6,692
Professional Services	9.8	12.4	15.7	15.4	206,111
Public Administration	4.3	4.3	4.3	4.2	56,212
Total	100.0	100.0	102.2	100.0	1,338,386

1/ Based on data in 1950 Census Table 84.

2/ Based on data in 1960 Census Table 125.

3/ For exact titles of industries and what activities each industry includes, see above tables. "Industry not reported" was neglected.

Instructions for Completing Worksheet V

Column (1): List all industries except agriculture.

Column (2): For each row: divide employment in that sector by total employment for all listed industries (and add 1) for 1950.

Column (3): Same as column (2) but for 1960.

Column (4): If $(3) > (2)$: $(4) = (3) - (2) + (3)$; if $(3) < (2)$:

$$(4) = (3) \times \frac{(3)}{(2)}$$

Column (5): The percentages in column (4) are here forced to equal 100.0. For each row divide percentage in that row in column (4) by total of column (4).

Column (6): For each row: multiply total projected employment in the listed industries (in this instance 1,338,386 obtained as in Worksheet I) by the percentage in that row in column (5).

WORKSHEET VIa
TENNESSEE

Projection of Relative Distribution Of Occupations by Industry[1/]

Industry	Professional Technical, etc.			Managers Officers, etc.			Clerical, etc.		
	1950	1960	1970	1950	1960	1970	1950	1960	1970
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Agriculture, etc.	.4	.9	1.4(1.4)	70.9	67.0	63.3(63.2)	.1	.4	.7(.7)
Mining	1.4	3.0	4.6(4.5)	3.2	6.0	8.8(8.7)	2.2	3.3	4.4(4.3)
Construction	3.4	3.8	4.2(4.2)	5.9	7.4	8.9(8.9)	3.2	3.4	3.6(3.6)
Manufacturing	3.8	5.0	6.2(6.1)	4.1	4.2	4.3(4.2)	8.0	9.0	10.0(9.9)
Transport, communication, etc.	3.0	4.8	6.6(6.6)	6.0	7.0	8.0(7.9)	21.0	21.3	21.6(21.4)
Trade	1.6	1.5	1.4(1.4)	23.1	19.4	16.3(16.2)	11.1	13.6	16.1(16.0)
Finance, Ins., etc.	2.5	2.5	2.5(2.5)	16.5	15.7	14.9(14.6)	39.5	46.5	53.5(52.6)
Business & Repair Ser.	5.2	6.7	8.2(8.0)	10.2	9.8	9.4(9.2)	8.9	14.2	19.5(19.1)
Personal Services	2.0	1.9	1.8(1.8)	3.6	3.5	3.4(3.4)	3.0	3.3	3.6(3.6)
Entertainment, etc.	22.0	16.0	11.5(11.2)	20.8	17.3	14.4(14.1)	13.2	13.2	13.2(12.9)
Professional Services	61.8	57.0	52.6(52.2)	2.3	2.7	3.1(3.1)	11.3	13.4	15.5(15.4)
Public Administration	12.0	13.7	15.4(15.2)	10.1	11.3	12.5(12.3)	44.4	43.1	41.9(41.4)

[1/] 1950 and 1960 ratios based on data in census tables 84 and 125 respectively. For exact titles of industry and occupation see these tables.

WORKSHEET VIb
TENNESSEE

Projection of Relative Distribution Of Occupations by Industry1/

Industry	Sales Workers			Craftsmen, Foremen, etc.			Operatives, etc.		
	1950 (11)	1960 (12)	1970 (13)	1950 (14)	1960 (15)	1970 (16)	1950 (17)	1960 (18)	1970 (19)
(1)									
Agriculture, etc.	.1	.1	.1(.1)	.1	.3	.5(.5)	.4	1.8	3.2(3.2)
Mining	.1	.6	1.1(1.1)	12.6	17.3	22.0(21.6)	79.5	68.7	59.4(58.4)
Construction	.2	.4	.6(.6)	57.4	54.5	51.7(51.5)	8.4	10.5	12.6(12.6)
Manufacturing	2.7	3.3	3.9(3.9)	15.8	16.4	17.0(16.8)	52.7	53.0	53.3(52.7)
Transport, communication, etc.	.3	.8	1.3(1.3)	20.8	20.9	21.0(20.8)	31.7	31.8	31.9(31.6)
Trade	29.0	27.6	26.3(26.1)	5.7	7.4	9.1(9.0)	12.8	14.0	15.2(15.1)
Finance, Ins., etc.	27.9	26.2	24.6(24.2)	2.1	1.9	1.7(1.7)	.8	.4	.2(.2)
Business & Repair Ser.	2.7	3.5	4.3(4.2)	55.9	44.8	35.9(35.2)	10.2	13.9	17.6(17.2)
Personal Services	.6	.5	.4(.4)	2.2	1.7	1.3(1.3)	17.2	13.0	9.8(9.7)
Entertainment, etc.	3.3	2.9	2.5(2.4)	8.7	8.0	7.4(7.2)	2.4	2.9	3.4(3.3)
Professional Services	.2	.2	.2(.2)	2.4	2.2	2.0(2.0)	1.6	1.3	1.1(1.1)
Public Administration	.2	.2	.2(.2)	6.9	6.9	6.9(6.8)	6.6	3.9	2.3(2.3)

1/ 1950 and 1960 ratios based on data in census tables 84 and 125 respectively. For exact titles of industry and occupation see these tables.

WORKSHEET VIc
TENNESSEE

Projection of Relative Distribution Of Occupations by Industry[1]

Industry	Service Workers,etc.			Laborers,(except mine)			Total		
	1950 (20)	1960 (21)	1970 (22)	1950 (23)	1960 (24)	1970 (25)	1950 (26)	1960 (27)	1970 (28)
(1)									
Agriculture, etc.	.1	.2	.3(.3)	27.9	29.3	30.7(30.6)	100.0	100.0	100.2
Mining	.8	1.1	1.4(1.4)	.2	--	-- --	100.0	100.0	100.7
Construction	.8	.5	.3(.3)	20.7	19.5	18.4(18.3)	100.0	100.0	100.3
Manufacturing	2.3	1.9	1.6(1.6)	10.6	7.2	4.9(4.8)	100.0	100.0	100.2
Transport, communication, etc.	3.6	3.1	2.7(2.7)	13.6	10.3	7.8(7.7)	100.0	100.0	100.9
Trade	13.2	12.5	11.8(11.7)	3.5	4.0	4.5(4.5)	100.0	100.0	100.7
Finance, Ins., etc.	8.6	5.2	3.1(3.0)	2.1	1.6	1.2(1.2)	100.0	100.0	101.7
Business & Repair Ser.	3.1	3.5	3.9(3.8)	3.8	3.6	3.4(3.3)	100.0	100.0	102.2
Personal Services	67.7	72.3	76.9(76.0)	3.7	3.8	3.9(3.8)	100.0	100.0	101.1
Entertainment, etc.	24.8	32.9	41.0(40.1)	4.6	6.8	9.0(8.8)	100.0	100.0	102.4
Professional Services	19.4	22.6	25.8(25.6)	1.0	.6	.4(.4)	100.0	100.0	100.7
Public Administration	15.3	17.2	19.1(18.8)	4.5	3.7	3.0(3.0)	100.0	100.0	101.3

1/ 1950 and 1960 ratios based on data in census tables 84 and 125 respectively. For exact titles of industry and occupation see these tables.

Instructions for Completing Worksheet VI

Column (1): List all industries including agriculture

Column (2), (5), (8), (11), (14), (17), (20) and (23): For each row: divide employment in the given professions in the given industry by total employment in that industry - for 1950.

Column (3), (6), (9), (12), (15), (18), (21) and (24): Same as above but for 1960.

Column (4), (7), (10), (13), (16), (19), (22) and (25): For each row of column (4), if $(3) > 2$: $(4) = (3) - (2) + (3)$; if $(3) < (2)$: $(4) = (3) \times \frac{(3)}{(2)}$. For column (7), if $(6) > 5$: $(7) = (6) - (5) + (6)$; if $(6) < (5)$: $(7) = (6) \ \frac{(6)}{(5)}$ etc. (The percentages between parenthesis are those of each row forced to 100.0. This is done as in column (5) of Worksheet V).

(Column (26), (27), and (28): These are the totals of the three previous steps.

WORKSHEET VIIa
TENNESSEE

Projected Distribution of Employment By Occupation (1970)

Industry (1)	Professional Technical etc. (2)	Managers Officers, etc. (3)	Clerical, etc. (4)	Sales Workers (5)	Craftsmen Foremen, etc. (6)
Agriculture, etc.	992	44,805	496	71	354
Mining	241	466	230	59	1,156
Construction	3,710	7,862	3,180	530	45,492
Manufacturing	26,452	18,213	42,930	16,912	72,851
Transport, Communication, etc.	5,388	6,450	17,471	1,061	16,982
Trade	3,560	41,196	40,687	66,371	22,886
Finance, Ins., etc.	1,573	9,184	33,087	15,223	1,069
Business & Repair Ser.	2,784	3,201	6,647	1,462	12,249
Personal Services	1,951	3,686	3,903	434	1,409
Entertainment, etc.	750	943	863	161	482
Professional Services	107,590	6,390	31,741	412	4,122
Public Administration	8,544	6,914	23,272	112	3,823
Total	163,535(11.6)	149,310(10.6)	204,507(14.5)	102,808(7.3)	182,875(13.0)

WORKSHEET VIIb
TENNESSEE

Projected Distribution of Employment By Occupation (1970)

Industry (1)	Operatives, etc. (7)	Service Workers, etc. (8)	Laborers (Except Mine) (9)	Total (10)
Agriculture, etc.	2,269	213	21,694	70,894
Mining	3,127	75	--	5,354
Construction	11,130	265	16,165	88,334
Manufacturing	228,527	6,938	20,814	433,637
Transport, Communication, etc.	25,799	2,204	6,287	81,642
Trade	38,398	29,752	11,443	254,293
Finance, Ins., etc.	126	1,887	755	62,904
Business & Repair Ser.	5,985	1,322	1,148	34,798
Personal Services	10,516	82,391	4,119	108,409
Entertainment, etc.	221	2,683	589	6,692
Professional Services	2,267	52,765	824	206,111
Public Administration	1,293	10,568	1,686	56,212
Total	329,658(23.4)	191,063(13.5)	85,524(6.1)	1,409,280(100.0)

Instructions for Completing Worksheet VII

Column (1): List all industries including agriculture.

Column (2)-(9): For each row: multiply total projected employment for that industry as obtained in Worksheet V (Note that agricultural employment was projected separately as in Worksheet I and this projection should be used for the first row) by the corresponding percentage for 1970 in Worksheet VI (use percentages between parenthesis).

Column (10): Total for each row.

The "total" line in last row indicates total employment in the given occupation. Between parenthesis are the percentage that the employment in this profession is expected to be of total employment in 1970. These percentages should of course add up to 100.0.

COMPUTER PROGRAMS

This section describes in detail the computer programs and the computations performed by each step in them. It is designed primarily for programmers and others who wish to use the programs to develop projections for their own States.

The programs were developed by the State Planning Office staff. They are written in the Fortran computer language for use on an IBM 1620 computer with an off-line printer. The programs should be modified if they are to be run on a computer with an on-line printer, or a computer with a larger capacity.[1] Data created by one program to be used an input to another were conveyed by means of punched cards.

There are nine programs. Each is explained in sequence. The order of explanation follows the flow chart which shows how output from one program becomes input to another. The programs are divided into two independent groups. One group of projections forecasts employment, population and the labor force. The other group projects the industrial and occupational distribution of employment.

Each program is photographically reproduced. Following the reproduction of the program is a detailed explanation. This explanation explains the computations performed by each step in the program.

The explanations should be read with care, since they concern themselves primarily with active computations. Particular attention should be paid to the format statements, since they show the ways in which the input cards should be punched and the output cards are punched. The format statements are not explicitly discussed in these explanations.[2] The program statements are referred to as "steps" in the explanations in order to save space.

It is hoped that these general statements will be combined with the introductions to the specific programs to produce a satisfactory conception of the types of information needed to adapt the programs to individual use.

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[1] Some suggested changes in the writing of programs for other types of computers are, for computers with on-line printers, changing all the "Punch" statements to "Print" statements. These would create direct printing of the results, instead of producing output in the form of punched cards for later printing by an off-line printer. It would also be desirable to put the output data onto tapes for easier transmittal of information between programs.

[2] Statements frequently appear in the programs such as "Read 3" (for input data) or "Punch 17" (for output). When these statements are found, refer to Statement 17, Statement 3, or to the statement named to find the format in which the input or the output data are to be punched.

FLOW CHART OF PROGRAMS

This flow chart shows how the output of one program becomes input to another. It should be noted that several programs have original input as well as input produced by other programs. This is especially true of the population and labor force projections program and the occupational projections program.

There are two main divisions of the projections. The first group is composed of the population projections. The second group is composed of the industry projections.

POPULATION PROJECTIONS

EMPLOYMENT PROJECTIONS PROGRAM → Non-9 cards print results
→ 9 cards are read into

→ 1970 POPULATION AND LABOR FORCE PROJECTIONS PROGRAM → Object #1 prints results
→ Object #2 makes two outputs

→ 9 cards provide 1950, 1960, 1970 population and labor force data by county, which are input to
→ Non-9 cards are input into the

→ 1980 POPULATION AND LABOR FORCE PROJECTIONS PROGRAM → Non-9 cards print results
→ 9 cards provide 1980 population and labor force data by county. These cards are also input to the

→ 1970-1980 POPULATION AND LABOR FORCE ACCUMULATIONS PROGRAM

INDUSTRIAL PROJECTIONS

Original industry data for 1950 and 1960 are input into the

→ INDUSTRY COMBINATION PROGRAM whose output is input into the

→ 1970-1980 INDUSTRY PROJECTIONS PROGRAM with three outputs

→ Non-9 cards print results
→ 99 cards used for an INDUSTRY ACCUMULATIONS PROGRAM.
→ 9 cards used as input into the

→ 1970-1980 OCCUPATIONAL PROJECTIONS PROGRAM with two outputs

→ Non-9 cards print results
→ 9 cards used for input into the

→ 1970-1980 OCCUPATIONAL ACCUMULATIONS PROGRAM

Employment Projection Program

This program is the first program in the population and labor force projections. It creates a projected employment figure which determines the projected population and labor force. Therefore, it is one of the most important programs in the entire series.

The program reads in Census data for employment (separated into agricultural and non-agricultural employment), projects it by two methods (geometric and arithmetic) and selects one of them as the final employment forecast.

This program is designed to project total employment figures for each county for 1970 and for 1980.

Step 8	Format statements 4 and 6 are punched in. The two headings appear in the printed output for each county.
Step 10	The county number and name are read. If the number is 99 or more, the program stops. A 99 card is inserted behind all the input data cards in order to halt data processing. Of course, if there are more counties in a state or region, this number can be modified.
Step 11	The basic data are read. The meanings of the symbols are given below.

CE1	Total employment in 1950 Census for the county.
CE2	Total Census employment for 1960 in the county.
COE(1)	Covered employment figures as given by the Tennessee Department of Employment Security. The letter (I) goes from 1 to 15 and represents the covered employment figures for each year from 1950 through 1964.
AG1	Agricultural employment for males in the 1950 Census.
AG2	Agricultural employment for females in the 1950 Census.
AG4	Total agricultural employment (both sexes) in the 1960 Census.

I CODE 1 = Males, I CODE 2 = Females,
I CODE 4 = Total

The next process is the establishment of agricultural and non-agricultural employment for 1950 and 1960, followed by the projections of employment for 1970.

AG50	represents total agricultural employment for 1950 and is obtained by summing male and female agricultural employment.
XAG50	represents non-agricultural employment for 1950 and is found by subtracting agricultural employment from total employment.
XAG60	represents non-agricultural employment for 1960 and is also found by subtracting agricultural from total employment.

The two projections for 1970 employment are undertaken at this point.

Agricultural employment (AG70) is projected with the assumption that the ratio of change of change of agricultural employment from 1960 to 1970 is the same as that from 1950 to 1960. This is done by squaring the 1960 agricultural employment and dividing this square by the 1950 agricultural employment.

The projected non-agricultural employment for 1970 (XAG70) is first determined by adding the 1950-1960 change in this employment class to the 1960 non-agricultural employment. This is done by multiplying the 1950-1960 change by two. The projected 1970 employment derived by this method is denoted by (CTA). The 1970 non-agricultural employment is then projected by the ratio method, in the same way as the agricultural employment was projected. The 1970 non-agricultural employment projected this way is denoted by (CTG).

Step 28 is a loop which establishes the relevant Employment Security data for processing. The Tennessee Department of Employment Security established a new definition of covered employment in 1956, so that the data are consistent only for 1956 through 1964. The first six figures in COE represent 1950 through 1955, so that relevant data is defined as Y(I)=COE (I+6).

Step 29 is a regression procedure by which the covered employment for each year (1956-1964) is increased by the 1960 ratio of total covered employment in order to obtain a satisfactory criterion by which to select either (CTA) or (CTG) as the 1970 projected employment. The ratio is as follows:

Non-agricultural employment (1970)=Covered employment (1970)
Non-agricultural employment (1960)=Covered employment (1960)

Step 30 is another regression procedure, which is probably allied with Step 29. At the end of this step, (KCTR) determines whether to proceed to the projection of population employment or to the punching of output.

Both these steps are used in projecting first 1970 employment, then in projecting 1980 employment.

Step 31 begins the projection of employment. Non-agricultural employment for 1970 (XAG70) is defined as the regression function on covered employment in 1960 (COE11) multiplied by non-agricultural employment in that year. This figure is added to the projected agricultural employment for 1970 (AG70) to obtain a figure which will be used in determining whether the geometric (CTG) or the arithmetic (CTA) projections will be selected as the final employment projection.

The difference between (CTG) and (CTA) was measured. If this difference was less than .1, the 1970 projected employment was assumed to be CTG, which is the second method mentioned in the methodology . If the difference was greater than .1, Step 35 is used.

Step 35 makes the final selection between (CTG) and (CTA). If the difference between (ESTA) and (CTA) is less, then the arithmetic projection is taken as the final figure. This means that the arithmetic projection is closer to the prelimanry total (ESTA). Otherwise, the geometric projection (CTG) is taken as final.

Step 40 feeds in data for the 1980 employment projections. The 1980 agricultural employment is defined by squaring the 1970 projected employment and dividing the square by the 1960 agricultural employment. Then the regression functions (Steps 29 and 30) are used again.

Step 33 (EE2) is defined as the 1980 projected employment. Then the output is punched.

The computer program for these projections follows.

```
*FANDK2810
      REGF (XJ)=A+B*XJ
      DIMENSION X (9), Y(9), XY(9), XSQ(9)
      DIMENSION COE (15), AG(4)
    1 FORMAT (I2, I1, 11F6.0)
    2 FORMAT (I2,4F8.0, 45X, 1H9)
    3 FORMAT (I2, A14)
    4 FORMAT (1H1, 1X, 38HCENSUS EMPLOYMENT PROJECTED EMPLOY-
                                                  MENT)
    5 FORMAT (I2, 2F6.0)
    6 FORMAT (1H, 17X, 4H1950, 6X, 4H1960, 6X, 4H1970, 6X, 4H1980)
    7 FORMAT (1H, 14X, 4(F8.0,2X))
    8 FORMAT (1H, A14)
      PUNCH 4
      PUNCH 6
   10 READ 3, ICTYNR, CNAME
      IF(ICTYNR-99)11,39,39
   11 READ 5, ICTY1, CE1, CE2
      READ 1, ICTY2, ICODE1, (COE(I), I=1,11)
      READ 1, ICTY3, ICODE2, (COE(I), I=12,15)
      READ 1, ICTY1, ICODE1, AG1
      READ 1, ICTY1, ICODE2, AG2
      READ 1, ICTY, ICODE4, AG4
      AG50=AG1+AG2
      XAG50=CE1-AG50
      XAG60=CE2-AG4
      AG70=(AG4**2)/AG50
      XAG70=2.0*XAG60-XAG50
      CTA=AG70+XAG70
      XAG70=0.0
      XAG70=(XAG60**2)/XAG50
      CTG=AG70+XAG70
      XAG70=0.0
   27 N=9
      DO 28 I=1,N
   28 Y(I)=COE(I+6)
      KCTR=0
   29 KCTR=KCTR+1
      SY=0
      SX=0
      SXY=0
      X(1)=0
      XY(1)=0
      XSQ(1)=0
      SXSQ=0
      XM=0.0
      DO 30 I=1,N
      XM=XM+1.0
      X(I)=XM
      XY(I)=X(I)*Y(I)
      SXY=XY(I)+SXY
      SX=X(I)+SX
      SY=Y(I)+SY
      XSQ(I)=X(I)**2
   30 SXSQ=XSQ(I)+SXSQ
      SXSY=SX*SY
      SQSX=SX**2
      XN=N

      B=(XN*SXY-SXSY)/(XN*SXSQ-SQSX)
      A=SY/XN-B*SX/XN
      GO TO (31,33), KCTR
   31 XAG70=(REGF(15.0)/COE(J1))*XAG60
      ESTA=XAG70+AG70
      XAG70=0.0
      DIFF=CTA-CTG
      DIFF=ABS(DIFF)
      DIFF=DIFF/CTA
      IF(DIFF-.1)34,34,35
   34 EE1=CTG
      GO TO 40
   35 DIFF1=ESTA-CTG
      DIFF2=ESTA-CTA
      DIFF1=ABS(DIFF1)
      DIFF2=ABS(DIFF2)
      IF(DIFF2-DIFF1)37,36,36
   36 EE1=CTG
      GO TO 40
   37 EE1=CTA
   40 XAG70=EE1-AG70
      AG80=(AG70**2)/AG4
      N=3
      Y(1)=XAG50
      Y(2)=XAG60
      Y(3)=XAG70
      GO TO 29
   33 EE2=REGF(4.0)+AG80
      PUNCH 8, CNAME
      PUNCH 7, CE1, CE2, EE1, EE2
      PUNCH 2, ICTYNR, CE1, CE2, EE1, EE2
      GO TO 10
   39 STOP
      END
```

1970 Population and Labor Force Projection Program

This program is one of the most basic programs in the population and labor force projections group. It processes the 1950 and 1960 Census data on population and labor force and makes a preliminary projection. This projection is then matched with the employment projection made by that program. If they do not match, other projections of population and labor force are made until a projection that matches with projected employment is arrived at.

This program projects population by age and sex. It also projects population by color where nonwhites represented 10 percent or more of the 1960 population of a county. In counties where the nonwhites are less than 10 percent of the population, the white and nonwhite populations were combined and the total population is projected as a group.

The discount and migration rates are also projected for each age-sex group.

The labor force is projected by age and sex. The program also produces projected participation rates for each age-sex group.

The output of this program is printed, and is also input to the 1980 population and labor force projections program and to the population and labor force accumulations program.

Step 9000 establishes the concept of the total male and female populations (TPPM and TPPF, respectively) for the 16 age groups considered in the population with totals for the two sexes.

Step 9010 establishes the concept of the total male labor force and the total female labor force (represented by (TPLFM) and (TPLFF), respectively) for each of the six age groups represented.

Step 57 establishes the concept of an arbitrary labor force participation rate for males (XMAXM).

Step 58 reads in the male and female labor force projection factors which are further described later in the program explanations.

Steps 59-60 read in the Sprague multipliers (denoted by (SPRM) used in projecting the age-sex composition of the labor force.

Steps 62-455 read in the mortality rates for white males, nonwhite males, white females and nonwhite females (represented by (RM1), (RM2), (RM3), and (RM4), respectively,). I=1, 14 and represents the 14 oldest age groups. Mortality rates were derived from standard life tables and were assumed equal for all counties.

Step 461 reads in the county number and name. In Tennessee, there are 95 counties. If county number (ICTYNR) equals 99, some final data are punched.

Step 63 This loop establishes the concept of discount rates (DR2 and DR4) and migration rates (RMIG2 and RMIG4) for nonwhite males and nonwhite females, respectively. This loop was done for the 14 oldest age groups.

Step 6701 This loop establishes the concept of discount rates (DR2 and DR4) and migration rates (RMIG2 and RMIG4) for nonwhite males and nonwhite females, respectively. This loop was done for the 14 oldest age groups.

Step 5700 ends a loop establishing the concept of the total population (POP2) and (POP4) for nonwhite males and nonwhite females, respectively, for the 16 age groups. The age groups are five-year groups from 0-4 up to 70-74 years, with one for all over 75 years.

Steps 69-75 read in the 1960 and 1950 populations for each age-sex-color group.

The 1960 white male population by age and sex is read in.

Step 69 reads in the 1960 nonwhite male population

Step 70 reads in the 1960 white female population.

Step 71 reads in the 1960 nonwhite female population.

Step 72 reads in the 1950 white male population.

Step 73 reads in the 1950 nonwhite male population.

Step 74 reads in the 1950 white female population.

Step 75 reads in the 1950 nonwhite female population.

Step 81 reads in the total populations of males and females in the six age groups used in labor force data. The male and female populations are denoted by (TMLP) and (TFLP), respectively. The total male and female labor forces ((XMLF) and (FLF) respectively) are then read. The populations and the labor forces are summed. The total male and female populations are represented by (TMLP) and (TFLP), respectively. The total male and female labor forces are represented by (TMLF) and (TFLF), respectively.

Step 84 CE1 and CE2 represent the Census employment for 1950 and 1960, respectively. EE1 and EE2 represent the projected 1970 and 1980 employment, which is output from the employment projections program.

Step 172 determines whether nonwhites represented 10 percent or more of the 1960 male population ((TOTPOP) represents total male population, (TOTAL1) white males, (TOTAL2) nonwhite males).

Step 174 gives similar consideration to females.

Step 175, which is used only if the nonwhites represented less than 10 percent of the 1960 population, combines the white and nonwhite populations into one group for projections purposes. The nonwhite population is projected separately if it was 10 percent or more of the total 1960 population.

Step 176 comprises a loop which computes the discount rate for the white population in each sex and each of the 13 youngest age groups (64 years or less) in 1950. The discount ratio is the percentage of people in the ^{1}th age group in 1950 who remained in the (^{1}th+2) age group in 1960; or the percentage of people in a certain age group in 1950 who were 10 years older and still in the county in 1960. (DR1(I) is the discount ratio for white males in the ^{1}th age group.

Step 178 computes the discount ratios for white males and white females over 65 years of age in 1950. Since this group would be over 75 years of age in 1960, the discount rate equals the 1960 population over 75 divided by the total. Symbol is (DR(1 or 3) (14)).

The statement If (INDIC-1) 181, 179, 179 tests for a nonwhite population over 10 percent.

Steps 179 and 180 compute the discount ratios for nonwhite males and females in the same way if the nonwhite population percentage exceeded ten.

Step 181 determines the migration rates for white males (RMIG1) and white females (RMIG3). The migration rate is determined by subtracting the mortality rates (RM1(I)) or (RM3(I)) of the ^{1}th age group of white males or white females from the discount ratios.

Step 182 (OMIG(1 or 3)) is defined as the equal of (RMIG (1 or 3) (I)).

Step 1903 tests for a nonwhite population of ten percent or more. If it is, migration rates for nonwhite males and females (RMIG2(I) and (RMIG4(I) respectively)) are determined in the same way as for whites. (OMIG2(I)) and (OMIG4(I)) are defined as equal to the two RMIG figures.

Step 191 tests for a nonwhite population of ten percent or more. If it is, migration rates for nonwhite males and females (RMIG2(I) and (RMIG4(I) respectively) are determined in the same way as for whites. (OMIG2(I) and (OMIG4(I) are defined as equal to the two RMIG fugures.

Steps 1904 and 1821 sum the migration rates for white males and for white females to determine if the county was an inmigration county or an outmigration county for these sex-color categories. (SMIG) means sum of the migration rates.

Steps 1822 and 1823 set the migration of white males (JWM) at 1 if there is an inmigration,at 0 if there is an outmigration.

Steps 1826, 1824 & 1825 sum the migration rates of each age group of white females. If the sum indicates inmigration, JWF=1; if there is an outmigration, JWF=0.

Step 1827 tests for a nonwhite percentage of 10 percent or more of the total. If there is, the migration figures for each age group of the nonwhite population are summed in Steps 1828 and 1921. If the nonwhite population was less than 10 percent, this sequence is skipped and the program resumes at Step 1926.

Step 1828 sums the migration rates of the nonwhite age-sex groups. (SMIG2) is the sum of the migration rates for nonwhite males, (SMIG4) is the sum of the rates for nonwhite females.

Steps 1922 and 1923 fix JNM=0 if there is an outmigration of nonwhite males and JNM=1 if there is an inmigration of nonwhite males.

Step 1924, 1925 and 1929 These steps determine the direction of migration for nonwhite females in the county. If there is an inmigration of nonwhite females, JNF=1; if there is an outmigration, JNF=0.

NOTE: "Inmigration" and "outmigration" as used above mean the arithmetic sum of the migration rates of the individual age groups in a color-sex category. An inmigration of white males means that the arithmetic sum of the migration rates for the age groups of white males was greater than one.

Steps 1926, 1927, and 1928 These steps add the arithmetic sums of the color-sex categories (SMIG1, 2, 3, or 4) and thereby determine the direction of migration of the entire county population. If there is an inmigration, JT=1; if there is an outmigration, JT=0.

Step 1881 This step intruduces the migration rate adjustment factor. The symbols mean: NG= the current status of the migration rates. Zero means no change has occurred. One means that a reversal of direction has occurred. X=migration rate adjustment factor.

Step 183 (X) is assumed to be 1.00 for the first attempt to reach an acceptable employment rate. The program proceeds under this assumption. If this first attempt fails, the other possible factors listed in Steps 184 through 189 will be called in.

Step 190 If, as explained in the methodology, the migration rate adjustment factor for a sex-color category in an outmigration county was reduced from 1.00 to, say, 0.75; then the factor for a specific age group within that sex-color category that showed an inmigration would have its factor increased from 1.00 to 1.25. The reverse is also true.

This step establishes the sum of the factor (denoted by CX) sex-color for a category and the factor for an age group within the category moving in an opposite direction from that of the category (Y) at 2.0 - X.

Step 1901 and 1902 These steps define (Y) as 1.0 + (X) if the direction of migration has changed.

Step 1905 This step, used only if the change in direction of migration for the entire county population has been from outmigration to inmigration, makes the absolute value of (X) and (Y) positive, regardless of its sign.

Step 193 This step initiates a long loop which projects the 1970 population of white males and white females under 65 years of age.

Step 194 This step, used only if there was an outmigration of white males in the ^{i}th age group, uses the reverse of the rate of outmigration as an absolute migration rate. This rate is denoted as (AMIG1 (I)).

Step 195 establishes the rate of inmigration of white males in the ^{i}th age group as the absolute migration rate (AMIG1(I) in counties where inmigration occurred.

```
TEMP=X
X=Y
Y=TEMP
```

is a procedure which is performed whenever the direction of migration of a color-sex category (examples are JF or JNM) is different from the direction of migration of the total county population (JT). It is performed before the projection of the population of the individual cohorts within the color-sex category. The procedure seems to be some kind of reversal, and it is restored after the age cohorts within the color-sex category are projected. The youngest age categories are projected first, followed by a separate projection for the oldest age cohort in each color-sex category. This reversal seems to be necessitated by the use of 2.0 minus the migration rate adjustment factor as (AMIG) where there is an outmigration of a color-sex category in a county.

The steps given below are the steps which carry out this procedure. They are labeled "Reversal" or "Restoration", according to the purpose of the step.

Step 1952	Reversal	
Step 1981	Restoration	YOUNG WHITE MALES (Under 75 years)
Step 2022	Reversal	YOUNG WHITE FEMALES
Step 2041	Restoration	
Step 2071	Reversal	OLD WHITE MALES (75 years and over)
Step 2101	Restoration	
Step 2141	Reversal	
Step 2161	Restoration	OLD WHITE FEMALES
Step 2211	Reversal	
Step 2241	Restoration	YOUNG NONWHITE MALES
Step 2281	Reversal	
Step 2301	Restoration	YOUNG NONWHITE FEMALES
Step 2341	Reversal	
Step 2361	Restoration	OLD NONWHITE MALES
Step 2401	Reversal	
Step 2421	Restoration	OLD NONWHITE FEMALES

Step 1951 If the direction of migration of white males is different from that of the total population step 1952 is used.

Step 1952 makes (X)=(Y)=(TEMP).

Step 196 If the AMIG of the ^{i}th age group of white males is
less than zero (which will occur in counties with an
outmigration in this group), the projected 1970 population of white males in the (^{i}th+2) age group is
determined by taking the 1960 Census population of
the ^{i}th age group (AGE1(I)) and multiplying it by the
Step 197 rate of mortality. Then (Y) is multiplied by (OMIG1(I))
and the two products are summed. (OMIG) is equal to
Step 198 RMIG or the absolute value of RMIG, depending on whether
or not a reversal of the direction of migration has
occurred. If the county is an inmigration county, (X)
replaces (Y) in the calculation.

Step 1980
Step 1981

NOTE; These projections are made for age groups within the color-sex categories at this time, and the size of groups less than 65 years of age in 1960 that will under 75 years of age in 1970 are projected at this time.

Steps 200 through 2041 project the 1970 population for white females in the same way as for the white males.

Step 205 ends the projection of white male and female population and begins the projection of the white male and female population that will be over 75 years of age in 1970. (TOT) means the total 1960 white male population then 65 years of age or over.

Step 206 sets the absolute value of the migration equal to the
negative migration rate if there was an outmigration
Step 207 of white males over 65 years of age. AMIG equals migration rate for inmigration counties.

Steps 208, 209 and 210 project the population 75 years of age and over in 1970 using the same method as was described above for younger white males.

Steps 211 through 2161 project the 1970 white female population over 75 years of age in the same manner in which the white male population over 75 was projected.

Step 217 sets up the procedures for projecting the 1970 population of white males and white females 0-4 and 5-9 years of age. The DO loop involving Steps 217 and 218 first collect the 1960 and the projected 1970 white females population ages 15-49 years. Age group 4 is (15-19) years through age group 10 (45-49 years).

Step 218 TOT1 equals white females 15-49 years in 1960.
TOT 2 equals projected population of white females 15-49 years in 1970.
A RATIO of these totals is taken.
Then the 1970 projected populations of white males and white females in the two youngest age groups is obtained by multiplying this ratio by the 1960 white male and white female populations for each of the two youngest age groups.
POP1=White Males POP2=White Females;
AGE(1) = 0-4 years AGE(2) = 5-9 years.

The basic equation for the derivation of projected populations of the age groups (0-4) or (5-9) years is:

$$\mathrm{POP}^{70}\begin{matrix}(0\text{-}4)\\ \text{or}\\ (5\text{-}9)\end{matrix} = \frac{F^{70}(15\text{-}49)}{F^{60}(15\text{-}49)} \cdot \mathrm{POP}^{60}\begin{matrix}(0\text{-}4)\\ \text{or}\\ (5\text{-}9)\end{matrix}$$

This also applies to steps 243 and 244.

Step 219 is the first step in the procedure to project the 1970 nonwhite male and female populations for those counties in which nonwhites comprised 10 percent or more of the 1960 population. The statement IF (INDIC-1)247,219, 219 tests for the nonwhite population of 10 percent or more. If the nonwhite population is less than 10 percent, the program goes directly to Step 247 to determine the total populations by race and sex. If nonwhites are less than 10 percent of the 1960 population, nonwhite and whites are projected as a total.

Steps 219 thru 224 generate 1970 projected nonwhite male population for ages 10 thru 74, in the same way that white male population for 1970 in this age range was projected.

Steps 225 thru 231 project 1970 nonwhite female population ages 10 through 74 years in the same way as white females population in these age groups.

Steps 232 through 2401 project nonwhite male populations in 1970 for age 75 years and over in the same way that the 1970 white male population over 75 years of age was projected.

Steps 240 through 2421 project 1970 nonwhite female populations 75 years of age and over in the same way as the white female population of this age range was projected.

Steps 243 and 244 project the 1970 nonwhite male and female populations for the two age groups 0-4 years and 5-9 years in the same way that the white male and female populations in these age groups was projected.

Step 247 begins the addition of the four color-sex groups to obtain the total projected 1970 populations for males, females, whites, and nonwhites. The symbol meanings are as follows:

TPOP1 means total white males
TPOP3 means total white females
TPOP2 means total nonwhite males
TPOP4 means total nonwhite females
TPOPM means total males
TPOPF means total females

Step 248 represents the end of a loop in which the white male and female age groups are summed to obtain the total 1970 projected white male and female populations. The IF statement tests for 1960 nonwhite population of 10 percent of more of the total populations. If the nonwhites comprise less than 10 percent of the 1960 population, Step 248 determines the total projected 1970 male and female populations.

Steps 249 and 251 sum the age groups of the nonwhite male and female populations to obtain the total nonwhite male and female populations for 1970 and add these to the white populations to obtain 1970 total male and female populations. TPOP2=obtain 1970 total male and female populations. TPOP2=nonwhite males; TPOP4= nonwhite females.

The next portion of the program derives the size of the labor force by age and sex (but not color) groups, and computes the labor force participation rate for each age-sex group.

Step 254 defines TPOP as being the sum of the total population of white and nonwhite males plus white and nonwhite females. The new symbols used in the labor force computation are defined below.

PM14 and PF14 mean the male and female populations 14 years of age. PM18, PF18, PM19, PF19= the male and female populations of those ages.

POPM(I) and POPF(I) or (I+1) mean the male and female populations of the ^{i}th five-year age groups. (POP(M)OR(F) (I+1) (^{i}th + 1)) mean male and female populations in the (^{i}th) or the (^{i}th + 1) age groups.

SPRM(I) or (I + 5) or (I + 10) mean the Sprague multipliers for one of these three age groups. The Sprague multipliers are used in a calculation in which the age groups used by the Bureau of the Census for population records are altered to conform to the groups used by that Bureau in labor force records.

XMLP2(I) and FLP2(I) mean the male and female populations, respectively of the ^{i}th age group. There are six age groups used in the labor force projections.

Group 1	14-17 years
Group 2	18-24 years
Group 3	25-34 years
Group 4	35-44 years
Group 5	45-64 years
Group 6	65-99 years

XMLF1(I) and FLF1(I) refer to the male and female labor forces in the ^{i}th age group.

XMPRP(I) and FPRP(I) are the actual number of males and females in the ^{i}th age group that are in the labor force.

Step 254 involves the combination of the 16 age groups used in the population calculation into the six groups used in labor force calculations. The Sprague multipliers are used to convert the 10-14 year, the 15-19 year, and the 20-24 year age groups used in population calculations into the 14-17 and the 18-24 year age groups used in labor force calculations. The populations in these age groups are determined through use of the Sprague multipliers. The Sprague multipliers used in the program are given in the worksheets.

Step 302 The four labor force age groups involving the population 25 years of age and older conform to the population age groups. The populations in each of the older labor force age groups can be determined simply by combining the appropriate population age groups.

Step 303 calculates the projected labor force participation rates for 1970. The projected rate for males in the ^{i}th age group (XMPRP(I)) was determined by multiplying the male participation rate by the male projection factor (XMPF(I)), because the relative change in male participation rates from 1950-1960 on a state-wide basis (1950 labor force participation data were not available by counties) governed. The projected female labor force participation rate for the ^{i}th age group (FPRP(I)) was determined by adding the female projection factor (FPF(I)) to the 1960 female participation rate.

XMPR(I) and FPR(I) are the 1970 male and female labor force participation rates respectively, for the ^{i}th age group.

XMLP(I) and FLP(I) are the 1970 populations for the males and females in the ^{i}th age group.

XMLF(I) and FLF(I) are the 1960 male and female labor forces for the ^{i}th age group.

The projected 1970 labor force participation rates for each age-sex group are then determined.

XMPRP(I) and FPRP(I) are the projected 1970 labor force participation rates for males and females, respectively, for the ^{i}th age group.

XMPR(I) and FPR(I) are the participation ratios for the ^{i}th age group.

XMPF(I) and FPF(I) are the male and female projection factors for the ^{i}th age group.

The male participation rates were projected by multiplying the projection ratios by the projection factors. For females, however, the rapid increases in female participation rates caused unreasonably high projected rates when used in this process. Therefore, the female rates were projected by adding the ratios to the projection factors.

Step 305 It was considered mandatory to set maximum limits for participation rates into the program in order to

prevent the possibility of nonsensical rates being created by the computer. Since the participation rates for all other male age groups had declined in the past, it was considered necessary to set a maximum limit of 98 percent participation on only the 25-34 year age group (Group 3).
This maximum is denoted by XMAXM(3).
NOTE: Maximum participation rates were set for all female age groups. Dimension space was reserved for maximum rates for females which was denoted by XMAXF. However, this term does not appear in the actual program.

Step 306 sets the maximum participation rates for males 25-34 years of age at 98 percent in all cases where the original computed rate exceeds this value.

Step 307 This step determines the total number of people in the labor force for each age-sex group in 1970.

Step 308 This step determines the total number of males and females in the labor force by adding the number of males or of females in the labor force for each age group. It also determines the rate by dividing EE1 for the total labor force (sum of males and females).
EE1= Employment rate for 1970

The loop ending in step 308 determined the 1970 projected labor force in each age-sex group by multiplying the projected labor force participation rate for males and females (XMPRP(I)) and (FPRP(I)) by the projected populations for 1970 in these groups. Then the total number of males and females in the labor force is determined by summing the figures for each age group by males and by females. Then males and females in the labor force are summed in order to obtain the total labor force projected for 1970 (TPLF2=TMLF2+TFLF2).

The 1970 projected employment rate is then set by dividing the rate (EE1) by the total projected labor force for that year.

NOTE: If the program takes too long to process a county, the employment rate being calculated by the computer is outside the acceptable limits of 90 to 96 percent. In this case, Sense Switch 1 is thrown on in order to determine what figures the machine has computed.

Step 7099 The computer types out the employment rate (RATE), the migration status of the base decade (JT), the migration rate adjustment factor being used at the time (X) and the current status of the migration rates (NG) where 0 indicates no change in status and 1 indicates a change in direction of the rates.

Step 7101 and 7102 If Sense Switch 2 is thrown on, a new migration rate adjustment factor can be inserted into the program. This provision meets the possibility of the 0.25 change in the migration rate adjustment factor causing a pass through the 90-96 percent range. At this point, the program recycles to Step 190 and begins computing again using the new rate. In practice, the computer types out a new employment rate. If the employment rate does not fall at or between 90 and 96 percent, a new rate can be typed in.

Step 7100 and 310 These steps are taken if the Sense Switches are not thrown on. If the employment rate falls within the limits of 90 to 96 percent, the program begins to produce output. If the rate falls outside the limits, other things happen. If the rate is higher than 96 percent, J equals 1; if the rate is less than 90 percent, J equals 2. In all cases, if (IND equals 1) (in cases where RATE is more than 96 percent or less than 90 percent), the migration rate adjustment factor (X) equals 1.50 and processing starts over from that point.

If (IND) is not equal to 1, Steps 3121 through 323 call in the possible new migration rate adjustment factors contained in Steps 183 through 189, also Steps 317 or 7099. Follow steps 317 thru 321 closely for redefinition of (OMIG) Step 7099 allows access to the console typewriter for a new employment rate.

Step 311 is the main routine that is followed when the rate does fall within the 90 to 96 percent range. The program begins to produce output. First, the county number and name are punched. Then a number of categories are set up. Most of these are self-explanatory. (ICATG) and (LND) are some kind of order sequencers. Then two almost identical sets of projected 1970 population by age and sex groups are produced. Those cards punched according to Step 8000 are used to actually print the 1970 projected population. The cards punched according to Step 8001 have 9's punched in the last column (or possibly the first column instead) and are used as input for the 1980 population projections. These projections are made for age-sex-color groups rather than for age-sex groups alone.

Steps 8010 thru 8020 incorporate the punching of the two sets of output for the 1960 population of the counties by age-sex-color groups.

Steps 8020 to 8030 incorporate the punching of 1950 population data for age-sex color groups. Only one set of this data is necessary, which is input to the 1980 population projections. A change in these cards is that the last part of each output statement should read (AGE5 . . . 8(I), I=N,M) instead of (AGE1. . . 4(I), I=N,M).

Steps 8030 to 401 incorporate the punching of 1960 actual and 1970 projected labor force numbers by age and sex groups. This output, like the 1970 projected population, is produced twice; once for printing, and again for input to the 1980 labor force projections. The employment rates are then punched; followed by the punching of the male and female projected labor force participation rates for 1970. Finally, the overall employment rate (which is between 90 and 96 percent) is punched.

Step 401 and 9020 This loop computes the total projected 1970 populations by age and sex by summing the projected populations in each age-sex group.

Step 9030 The total number of males and females in the labor force is obtained by summing the number of males and females in the labor force for each of the six age groups. After this is done, the program goes to Step 461 to read in another county and begin the entire program over again. (STEP 461 IS ON PAGE 1 OF PROGRAM)

Step 400 is taken after every county in the state has been read. A card with 99 punched in cc 79-80 is inserted after the last data card in the deck in order the ensure the completion of the program. A card with a larger number can be inserted in place of this 99 card if there are more than 99 counties in a state or region under consideration.

Step 400 punches in the total 1970 population by sex for the county.

Step 9050 punches in the total 1970 projected labor force by age-sex groups for the state of the region. This step completes the program.

The computer program for these projections follows:

```
DIMENSION TPPM(18), TPPF(18, TPLFM(6), TPLFF(6)
DIMENSION AGE1(18), AGE2(18), AGE3(18), AGE4(18), AGE5(18)
DIMENSION AGE7(18), AGE8(18), DR1(14), DR2(14),
  DR3(14), DR4(14)
DIMENSION RM1(14), RM2(14), RM3(14), RM4(14), RMIG1(14)
DIMENSION RMIG2(14), RMIG3(14), RMIG4(14), POP1(18),
  POP2(18)
DIMENSION POP3(18), POP4(18)
DIMENSION AGE6(18)
DIMENSION AMIG1(14), AMIG3(14), AMIG2(14), AMIG4(14)
DIMENSION OMIG1(14), OMIG2(14), OMIG3(14), OMIG4(14)
DIMENSION XMAXF(6)
DIMENSION XMPR(6), FPR(6)
DIMENSION XMPF(6), FPF(6)
DIMENSION XMPRP(6), FPRP(6)
DIMENSION SPRM(15)
DIMENSION XMLP1(6), FLP1(6)
DIMENSION XMLP2(6), FLP2(6)
DIMENSION POPM(16), POPF(16)
```

```
      DIMENSION XMLF1(6), FLF1(6)
      DIMENSION XMLF2(6), FLF2(6)
      DIMENSION NAME(5), IXAGE(22,2)
      READ 5020, ((IXAGE(I,II),II=1,2), I=1,22)
 5020 FORMAT(40I2)
    1 FORMAT (I1, 14F3.3)
    6 FORMAT (I2, 5A2)
    7 FORMAT (I2, I1, I1, 13F5.0)
    8 FORMAT (I2, I1, I1, 3F5.0, F6.0)
   24 FORMAT (7F2.2)
   25 FORMAT (I1, 11F6.4)
   26 FORMAT (I2, I1, 6F5.0, F7.0)
   42 FORMAT (12F5.4)
   56 FORMAT (I2, 4F8.0)
      DO 9000 I=1,18
      AGE 1(I)=0.0
      TPPM(I)=0.0
 9000 TPPF(I)=0.0
      DO 9010 I=1,6
      TPLFM(I)=0.0
 9010 TPLFF(I)=0.0
   57 READ 24, XMAXM
   58 READ 42, (XMPF(I),I=1,6), (FPF(I), I=1,6)
   59 READ 25, ICODE1, (SPRM(I),I=1,11)
   60 READ 25, ICODE2, (SPRM(I),I=12,15)
   62 READ 1, ICODE, (RM1(I), I=1,14)
  451 READ 1, ICODE, (RM2(I), I=1,14)
  453 READ 1, ICODE, (RM3(I), I=1,14)
  455 READ 1, ICODE, (RM4(I), I=1,14)
  461 READ 6, ICTYNR,NAME
      IF(ICTYNR-99)63,400,400

   63 DO 6701 I=1,14
      DR2(I)=0.0
      DR4(I)=0.0
      RMIG2(I)=0.0
 6701 RMIG4(I)=0.0
      DO 5700 I=1,16
      POP2(I)=0.0
      POP4(I)=0.0
 5700 CONTINUE
      READ 7, ICTY1, IRS1, ICODE1, (AGE1(I), I=1,13)
      READ 8, ICTY2, IRS2, ICODE2, AGE1(14), AGE1(15), AGE1(16),
        TOTAL1
 69     READ 7, ICTY1, IRS1, ICODE1, (AGE2(I), I=1,13)
        READ 8, ICTY2, IRS2, ICODE2, AGE2(14), AGE2(15), AGE2(16),
          TOTAL2
 70     READ 7, ICTY1, IRS1, ICODE1, (AGE3(I), I=1,13)
        READ 8, ICTY2, IRS2, ICODE2, AGE3(14), AGE3(15), AGE3(16),
          TOTAL3
 71     READ 7, ICTY1, IRS1, ICODE1, (AGE4(I), I=1,13)
        READ 8, ICTY2, IRS2, ICODE2, AGE4(14), AGE4(15), AGE4(16),
          TOTAL4
 72     READ 7, ICTY1, IRS1, ICODE1, (AGE5(I), I=1,13)
        READ 8, ICTY2, IRS2, ICODE2, AGE5(14), AGE5(15), AGE5(16),
          TOTAL5
 73     READ 7, ICTY1, IRS1, ICODE1, (AGE6(I), I=1,13)
        READ 8, ICTY2, IRS2, ICODE2, AGE6(14), AGE6(15), AGE6(16),
          TOTAL6
 74     READ 7, ICTY1, IRS1, ICODE1, (AGE7(I), I=1,13)
        READ 8, ICTY2, IRS2, ICODE2, AGE7(14), AGE7(15), AGE7(16)
 75     READ 7, ICTY1, IRS1, ICODE1, (AGE8(I), I=1,13)
        READ 8, ICTY2, IRS2, ICODE2, AGE8(14), AGE8(15), AGE8(16)
        READ 26, ICTY1, IS1, (XMLP1(I), I=1,6), TMLP1
        READ 26, ICTY2, IS2, (FLP1(I),I=1,6),TFLP1
 81     READ 26, ICTY1, IS1, (XMLF1(I),I=1,6),TMLF1
        READ 26, ICTY2, IS2, (FLF1(I),I=1,6),TFLF1
 84     READ 56, ICTY, CE1, CE2, EE1, EE2
172     TOTPOP=TOTAL1+TOTAL2
        PERCNT=TOTAL2/TOTPOP
        INDIC=0
        IF (PERCNT-.1)174,173,173
173     INDIC=1
        GO TO 176
174     TOTPOP=TOTAL3+TOTAL4
        PERCNT=TOTAL4/TOTPOP
        IF (PERCNT-.1)175,173,173
175     DO 177 I=1,16
        AGE1(I)=AGE1(I)+AGE2(I)
        AGE3(I)=AGE3(I)+AGE4(I)
        AGE5(I)=AGE5(I)+AGE6(I)
177     AGE7(I)=AGE7(I)+AGE8(I)
176     DO 178 I=1,13
        DR1(I)=AGE1(I+2)/AGE5(I)
178     DR3(I)=AGE3(I+2)/AGE7(I)
        TOT=0.0
        TOT=AGE5(14)+AGE5(15)+AGE5(16)
        DR1(14)=AGE1(16)/TOT
```

```
      TOT=0.0
      TOT=AGE7(14)+AGE7(15)+AGE7(16)
      DR3(14)=AGE3(16)/TOT
      IF(INDIC-1)181,179,179
 179  DO 180 I=1,13
      DR2(I)=AGE2(I+2)/AGE6(I)
 180  DR4(I)=AGE4(I+2)/AGE8(I)
      TOT=0.0
      TOT=AGE6(14)+AGE6(15)+AGE6(16)
      DR2(14)=AGE2(16)/TOT
      TOT=0.0
      TOT=AGE8(14)+AGE8(15)+AGE8(16)
      DR4(14)=AGE4(16)/TOT
      TOT=0.0
 181  DO 182 I=1,14
      RMIG1(I)=DR1(I)-RM1(I)
      RMIG3(I)=DR3(I)-RM3(I)
      OMIG1(I)=RMIG1(I)
 182  OMIG3(I)=RMIG3(I)
1903  IF(INDIC-1)1904,191,191
 191  DO 192 I=1,14
      RMIG2(I)=DR2(I)-RM2(I)
      RMIG4(I)=DR4(I)-RM4(I)
      OMIG2(I)=RMIG2(I)
 192  OMIG4(I)=RMIG4(I)
1904  SMIG1=0.0
      SMIG3=0.0
      DO 1821 I=1,14
      SMIG1=RMIG1(I)+SMIG1
1821  SMIG3=RMIG3(I)+SMIG3
      IF(SMIG1-0.0)1822,1823,1823
1822  JWM=0
      GO TO 1826
1823  JWM=1
1826  IF(SMIG3-0.0)1824,1825,1825
1824  JWF=0
      GO TO 1827
1825  JWF=1
1827  SMIG2=0.0
      SMIG4=0.0
      IF(INDIC-1)1926,1828,1828
1828  DO 1921 I=1,14
      SMIG2=RMIG2(I)+SMIG2
1921  SMIG4=RMIG4(I)+SMIG4
      IF (SMIG2-0.0)1922,1923,1923
```

```
1922    JNM=0
        GO TO 1929
1923    JNM=1
1929    IF(SMIG4-0.0)1924,1925,1925
1924    JNF=0
        GO TO 1926
1925    JNF=1
1926    SMIG=SMIG1+SMIG3+SMIG2+SMIG4
        IF(SMIG-0.0)1927,1928,1928
1927    JT=0
        GO TO 1881
1928    JT=1
1881    NG=0
        N=0
        K=0
        J=0
        IND=0
 183    X=1.00
        GO TO 190
 184    X=0.75
        GO TO 190
 185    X=0.50
        GO TO 190
 186    X=0.25
        GO TO 190
 187    X=0.00
        GO TO 190
 188    X=1.25
        GO TO 190
 189    X=1.50
        GO TO 190
 190    Y=2.00-X
1901    IF(NG-1)193,1902,1902
1902    Y=1.00+X
        IF(JT-0)193,193,1905
1905    X=-X
        Y=-Y
 193    DO 205 I=1,13
        IF(JWM-1)194,195,195
 194    AMIG1(I)=-RMIG1(I)
        GO TO 1951
 195    AMIG1(I)=RMIG1(I)
1951    IF(JT-JWM)1952,196,1952
1952    TEMP=X
        X=Y
        Y=TEMP
 196    IF(AMIG1(I)-0.0)198,197,197
 197    POP1(I+2)=AGE1(I)*(RM1(I)+X*(OMIG1(I)))
        GO TO 1980
 198    POP1(I+2)=AGE1(I)*(RM1(I)+Y*(OMIG1(I)))
1980    IF(JT-JWM)1981,199,1981
1981    TEMP=X
        X=Y
        Y=TEMP
 199    IF(JWF-1)200,201,201
 200    AMIG3(I)=-RMIG3(I)
        GO TO 2011
 201    AMIG3(I)=RMIG3(I)
2011    IF(JT-JWF)2022,202,2022
2022    TEMP=X
        X=Y
        Y=TEMP
 202    IF(AMIG3(I)-0.0)204,203,203
 203    POP3(I+2)=AGE3(I)*(RM3(I)+X*(OMIG3(I)))
        GO TO 2040
 204    POP3(I+2)=AGE3(I)*(RM3(I)+Y*(OMIG3(I)))
2040    IF(JT-JWF)2041,205,2041
2041    TEMP=X
        X=Y
        Y=TEMP
 205    CONTINUE
        TOT=AGE1(14)+AGE1(15)+AGE1(16)
        IF(JWM-1)206,207,207
 206    AMIG1(14)=-RMIG1(14)
        GO TO 2070
 207    AMIG1(14)=RMIG1(14)
2070    IF(JT-JWM)2071,208,2071
2071    TEMP=X
        X=Y
        Y=TEMP
 208    IF(AMIG1(14)-0.0)210,209,209
 209    POP1(16)=TOT*(RM1(14)+X*(OMIG1(14)))
        GO TO 2100
 210    POP1(16)=TOT*(RM1(14)+Y*(OMIG1(14)))
2100    IF(JT-JWM)2101,211,2101
2101    TEMP=X
        X=Y
        Y=TEMP
 211    TOT=AGE3(14)+AGE3(15)+AGE3(16)
        IF(JWF-1)212,213,213
 212    AMIG3(14)=-RMIG3(14)
        GO TO 2130
 213    AMIG3(14)=RMIG3(14)
2130    IF(JT-JWF)2141,214,2141
2141    TEMP=X
        X=Y
        Y=TEMP
 214    IF(AMIG3(14)-0.0)216,215,215
 215    POP3(16)=TOT*(RM3(14)+X*(OMIG3(14)))
        GO TO 2150
 216    POP3(16)=TOT*(RM3(14)+Y*(OMIG3(14)))
2150    IF(JT-JWF)2161,217,2161
2161    TEMP=X
        X=Y
        Y=TEMP
 217    TOT=0.0
        JND=0
        TOT1=0.0
        TOT2=0.0
        DO 218 I=4,10
        TOT1=TOT1+AGE3(I)
 218    TOT2=TOT2+POP3(I)
        RATIO=TOT2/TOT1
        POP1(1)=AGE1(1)*RATIO
        POP1(2)=AGE1(2)*RATIO
        POP3(1)=AGE3(1)*RATIO
        POP3(2)=AGE3(2)*RATIO
        IF(INDIC-1)247,219,219
 219    DO 231 I=1,13
        IF(JNM-1)220,221,221
 220    AMIG2(I)=-RMIG2(I)
        GO TO 2220
 221    AMIG2(I)=RMIG2(I)
2220    IF(JT-JNM)2211,222,2211
2211    TEMP=X
        X=Y
        Y=TEMP
 222    IF(AMIG2(I)=0.0)224,223,223
 223    POP2(I+2)=AGE2(I)*(RM2(I)+X*(OMIG2(I)))
        GO TO 2240
 224    POP2(I+2)=AGE2(I)*(RM2(I)+Y*(OMIG2(I)))
2240    IF(JT-JNM)2241,225,2241
2241    TEMP=X
        X=Y
        Y=TEMP
 225      IF(JNF-1)226,227,227
 226      AMIG4(I)=-RMIG4(I)
          GO TO 2280
 227      AMIG4(I)=RMIG4(I)
2280      IF(JT-JNF)2281,228,2281
2281      TEMP=X
          X=Y
          Y=TEMP
 228      IF(AMIG4(I)-0.0)230,229,229
 229      POP4(I+2)=AGE4(I)*(RM4(I)+X*(OMIG4(I)))
          GO TO 2300
 230      POP4(I+2)=AGE4(I)*(RM4(I)+Y*(OMIG4(I)))
2300      IF(JT-JNF)2301,231,2301
2301      TEMP=X
          X=Y
          Y=TEMP
 231      CONTINUE
          TOT=AGE2(14)+AGE2(15)+AGE2(16)
          IF(JNM-1)232,233,233
 232      AMIG2(14)=-RMIG2(14)
          GO TO 2330
 233      AMIG2(14)=RMIG2(14)
2330      IF(JT-JNM)2341,234,2341
2341      TEMP=X
          X=Y
          Y=TEMP
 234      IF(AMIG2(14)-0.0)236,235,235
 235      POP2(16)=TOT*(RM2(14)+X*(OMIG2(14)))
          GO TO 2360
 236      POP2(16)=TOT*(RM2(14)+Y*(OMIG2(14)))
2360      IF(JT-JNM)2361,237,2361
2361      TEMP=X
          X=Y
          Y=TEMP
 237      TOT=AGE4(14)+AGE4(15)+AGE4(16)
          IF(JNF-1)238,239,239
 238      AMIG4(14)=-RMIG4(14)
          GO TO 2400
 239      AMIG4(14)=RMIG4(14)
2400      IF(JT-JNF)2401,240,2401
2401      TEMP=X
          X=Y
          Y=TEMP
 240    IF(AMIG4(14)-0.0)242,241,241
 241    POP4(16)=TOT*(RM4(14)+X*(OMIG4(14)))
        GO TO 2420
 242    POP4(16)=TOT*(RM4(14)+Y*(OMIG4(14)))
2420    IF(JT-JNF)2421,243,2421
2421    TEMP=X
        X=Y
        Y=TEMP
 243    DO 244 I=4,10
        TOT1=TOT1+AGE4(I)
 244    TOT2=TOT2+POP4(I)
        RATIO=TOT2/TOT1
        POP2(1)=AGE2(1)*RATIO
        POP2(2)=AGE2(2)*RATIO
        POP4(1)=AGE4([illegible])*RATIO
        POP4(2)=AGE4(2)*RATIO
 247    TPOP1=0.
        TPOP2=0.
        TPOP3=0.
        TPOP4=0.
        TPOPM=0.0
        TPOPF=0.0
        DO 248 I=1,16
        POPM(I)=POP1(I)
        POPF(I)=POP3(I)
        TPOP1=TPOP1+POP1(I)
 248    TPOP3=TPOP3+POP3(I)
        IF(INDIC-1)254,249,249
 249    DO 251 I=1,16
        TPOP2=TPOP2+POP2(I)
        TPOP4=TPOP4+POP4(I)
        POPM(I)=POP1(I)+POP2(I)
        POPF(I)=POP3(I)+POP4(I)
        TPOPM=POPM(I)+TPOPM
 251    TPOPF=POPF(I)+TPOPF
 254    TPOP=0.
        TPOP=TPOP1+TPOP3+TPOP2+TPOP4
        PM14=0.0
        PF14=0.0
        PM18=0.0
        PF18=0.0
        PM19=0.0
        PF19=0.0
        DO 302 I=1,5
```

```
      PM14=POPM(I)*SPRM(I)+PM14
      PF14=POPF(I)*SPRM(I)+PF14
      PM18=POPM(I+1)*SPRM(I+5)+PM18
      PF18=POPF(I+1)*SPRM(I+5)+PF18
      PM19=POPM(I+1)*SPRM(I+10)+PM19
  302 PF19=POPF(I+1)*SPRM(I+10)+PF19
      XMLP2(1)=POPM(4)+PM14-PM18-PM19
      FLP2(1)=POPF(4)+PF14-PF18-PF19
      XMLP2(2)=POPM(5)+PM18+PM19
      FLP2(2)=POPF(5)+PF18+PF19
      XMLP2(3)=POPM(6)+POPM(7)
      FLP2(3)=POPF(6)+POPF(7)
      XMLP2(4)=POPM(8)+POPM(9)
      FLP2(4)=POPF(8)+POPF(9)
      XMLP2(5)=POPM(10)+POPM(11)+POPM(12)+POPM(13)
      FLP2(5)=POPF(10)+POPF(11)+POPF(12)+POPF(13)
      XMLP2(6)=POPM(14)+POPM(15)+POPM(16)
      FLP2(6)=POPF(14)+POPF(15)+POPF(16)
  303 DO 305 I=1,6
      XMPR(I)=XMLF1(I)/XMLP1(I)
      FPR(I)=FLF1(I)/FLP1(I)
      XMPRP(I)=XMPR(I)*XMPF(I)
      FPRP(I)=FPR(I)+FPF(I)
      CONTINUE
      IF(XMPRP(3)-XMAXM)307,307,306
  306 XMPRP(3)=XMAXM
  307 TMLF2=0.0
      TFLF2=0.0
      DO 308 I=1,6
      XMLF2(I)=XMLP2(I)*XMPRP(I)
      FLF2(I)=FLP2(I)*FPRP(I)
      TMLF2=XMLF2(I)+TMLF2
  308 TFLF2=FLF2(I)+TFLF2
      TPLF=TMLF2+TFLF2
      RATE=EE1/TPLF
      IF(SENSE SWITCH1)7099,7100
 7099 TYPE 7101, RATE, JT, X, NG
      K=9
 7101 FORMAT (F8.3,I4,F8.3,I4)
      IF (SENSE SWITCH2) 7102,7100
 7103 FORMAT (F10.0)
 7102 ACCEPT 7103,X
      GO TO 190
```

```
7100   IF(RATE-.96)310,310,3121
 310   IF(RATE-.90)3122,311,311
 311   CONTINUE
       PUNCH 5000, ICTYNR,NAME
5000   FORMAT (1H1,I2,5A2)
8000   FORMAT (I3,I1,I2,I1,I1,6F12.0)
8001   FORMAT (1H9,I2,I1,I2,I1,I1,6F12.0)
8002   FORMAT (I3,I1,I2,I2F5,2)
       LND=0
       ICATG=0
       IYR50=1
       IYR60=2
       IYR70=3
       IWM=1
       INWM=2
       IWF=3
       INWF=4
       N=1
       M=6
       ICATG=ICATG+1
       DO 8010 IX=1,3
       LND=LND+1
       PUNCH 8000, ICTYNR,ICATG,IYR70,IWM,LND,(POP1(I),I=N,M)
       PUNCH 8000, ICTYNR,ICATG,IYR70,INWM,LND,(POP2(I),I=N,M)
       PUNCH 8000, ICTYNR,ICATG,IYR70,IWF,LND,(POP3(I),I=N,M)
       PUNCH 8000, ICTYNR,ICATG,IYR70,INWF.LND,(POP4(I),I=N,M)
       PUNCH 8001, ICTYNR,ICATG,IYR70,IWM,LND,(POP1(I),I=N,M)
       PUNCH 8001, ICTYNR,ICATG,IYR70,INWM,LND,(POP2(I),I=N,M)
       PUNCH 8001, ICTYNR,ICATG,IYR70,IWF,LND,(POP3(I),I=N,M)
       PUNCH 8001, ICTYNR,ICATG,IYR70,INWF,LND,(POP4(I),I=N,M)
       N=N+6
       M=M+6
       IF(M-12)8010,8010,8011
8011   M=16
8010   CONTINUE
       LND=0
       N=1
       M=6
       DO 8020 IX=1,3
       LND=LND+1
       PUNCH 8000, ICTYNR,ICATG,IYR60,IWM,LND,(AGE1(I),I=N,M)
       PUNCH 8000, ICTYNR,ICATG,IYR60,INWM,LND,(AGE2(I),I=N,M)
       PUNCH 8000, ICTYNR,ICATG,IYR60,IWF,LND,(AGE3(I),I=N,M)
       PUNCH 8000, ICTYNR,ICATG,IYR60,INWF,LND,(AGE4(I),I=N,M)
       PUNCH 8001, ICTYNR,ICATG,IYR60,IWM,LND,(AGE1(I),I-N,M)
       PUNCH 8001, ICTYNR,ICATG,IYR60,INWM,LND,(AGE2(I),I=N,M)
       PUNCH 8001, ICTYNR,ICATG,IYR60,IWF,LND,(AGE3(I),I=N,M)
       PUNCH 8001, ICTYNR,ICATG,IYR60,INWF,LND,(AGE4(I),I=N,M)
       N=N+6
       M=M+6
       IF(M-12)8020,8020,8021
8021   M=16
8020   CONTINUE
       LND=0
       N=1
       M=6
       DO 8030 IX=1,3
       LND=LND+1
       PUNCH 8001, ICTYNR,ICATG,IYR50,IWM,LND,(AGE5(I),I=N,M)
       PUNCH 8001, ICTYNR,ICATG,IYR50,INWM,LND,(AGE6(I),I=N,M)
       PUNCH 8001, ICTYNR,ICATG,IYR50,IWF,LND,(AGE7(I),I=N,M)
       PUNCH 8001, ICTYNR,ICATG,IYR50,INWF,LND,(AGE8(I),I=N,M)
       N=N+6
       M=M+6
       IF(M-12)8030,8030,8031
8031   M=16
8030   CONTINUE
       LND=0
       IM=1
       IF=2
       ICATG=ICATG+1
       PUNCH 8000, ICTYNR,ICATG,IYR60,IM,LND,(SMLF1(I),I=1,6)
       PUNCH 8000, ICTYNR,ICATG,IYR60,IF,LND,(FLF1(I),I=1,6)
       PUNCH 8000, ICTYNR,ICATG,IYR70,IM,LND,(SMLF2(I),I=1,6)
       PUNCH 8000, ICTYNR,ICATG,IYR70,IF,LND,(FLF2(I),I=1,6)
       PUNCH 8001, ICTYNR,ICATG,IYR60,IM,LND,(SMLF1(I),I=1,6)
       PUNCH 8001, ICTYNR,ICATG,IYR60,IF,LND,(FLF1(I),I=1,6)
       PUNCH 8001, ICTYNR,ICATG,IYR70,IM,LND,(SMLF2(I),I=1,6)
       PUNCH 8001, ICTYNR,ICATG,IYR70,IF,LND,(FLF2(I),I=1,6)
       ICATG=ICATG+1
       IYRNN=0
       ISEX=0
       PUNCH 8000, ICTYNR,ICATG,IYRNN,ISEX,LND,CE1,CE2,EE1,EE2
       ICATG=ICATG+1
       PUNCH 8002, ICTYNR,ICATG,IYR60,(SMPR(I),I=1,6),(FPR(I),I=1,6)
       PUNCH 8002, ICTYNR,ICATG,IYR70,(XMPRP(I),I-1,6),(FPRP(I),I=1,6)
       ICATG=ICATG+1
       PUNCH 8002, ICTYNR,ICATG,IYR70,RATE
       GO TO 401
```

```
3121    J=1
        GO TO 312
3122    J=2
 312    IF(IND-1)313,189,313
 313    N=N+1
        GO TO (314,315),N
 314    RATE1=RATE
        GO TO 184
 315    GO TO (3151,3152),J
3151    IF(RATE1-RATE)323,316,316
3152    IF(RATE-RATE1)323,316,316
 316    N=1
        RATE1=RATE
        K=K+1
        GO TO (185,186,187,317,185,184,183,188,189,7099),K
 317    NG=1
 321    DO 322 I=1,14
        OMIG1(I)=ABSF(RMIG1(I))
        OMIG2(I)=ABSF(RMIG2(I))
        OMIG3(I)=ABSF(RMIG3(I))
 322    OMIG4(I)=ABSF(RMIG4(I))
        GO TO 186
 323    IND=1
        GO TO 188
 401    DO 9020 I=1,16
        TPPM(I)=POPM(I)+TPPM(I)
9020    TPPF(I)=POPF(I)+TPPF(I)
        DO 9030 I=1,6
        TPLFM(I)=XMLF2(I)+TPLFM(I)
9030    TPLFF(I)=FLF2(I)+TPLFF(I)
        GO TO 461
9040    FORMAT (6F12.0,6X,2H99)
 400    N=1
        M=6
        DO 9050 IX=1,3
        PUNCH 9040,(TPPM(I),I=N,M)
        PUNCH 9040,(TPPF(I),I=N,M)
        N=N+6
        M=M+6
        IF(M-12)9050,9050,9051
9051    M=16
9050    CONTINUE
        PUNCH 9040,(TPLFM(I),I=1,6)
        PUNCH 9040,(TPLFF(I),I=1,6)
        STOP
        END
```

1980 Population and Labor Force Projections

The methodology and computations performed by this program are practically identical to those performed by the 1970 population and labor force projections. There was a large portion of the program which is identical to the 1970 population and labor force projections program in the nature of its computations. Therefore, the explanation of this program will consider only those parts that differ from the 1970 program. The program uses the 1960 population figures and the 1970 projections as input for the generation of the 1980 population and labor force projections.

This program, like the 1970 program, produces two outputs. One prints the results, the other is input to the population and labor force accumulations program.

The reading in of input data takes place in a slightly different order in this program than in the 1970 program.

The first steps in the program was the assignment of dimension storage space for population, labor force, and migration data.

Step 5020 through Step 56 are format statements.

Step 57 reads in (XMAXM), which is the arbitrary maximum labor force participation rate used for males 25-34 years of age.

Steps 59 thru 461 involve the reading in of the Sprague multipliers and the mortality rates for the four age-sex groups.

Steps 63 through 5700 set up the concepts of discount rates (DR2 and DR4), migration rates (RMIG2 and RMIG4), and population groups (POP2 and POP4) all for the ^{i}th age groups. 2 probably represents males, 4 probably means females.

Steps 5700 through 8010 read in 1960 populations by age-sex-color groups.

AGE1 represents while males

AGE2 represents white females

AGE3 represents nonwhite males

AGE4 represents nonwhite females.

Steps 8010 through 8020 read in 1950 Census populations by age-sex-color groups. The same scheme for color is followed as for 1960, with AGE5 representing white males, AGE8 nonwhite females.

Step 8021 limits (M) to 16, as in the 1970 program.

Steps 8020 through 8030 read in labor force data by age-sex group.

XMLFO and FLFO mean 1960 labor force data, XMLF1 and FLF1 mean 1970 projected labor force data.

Then the employment rates (EE1 and EE2) are read in, along with the census employment (CE1 and CE2). The male and female labor force participation rates, for 1960 and projected 1970, respectively, are read in. The employment rate is read in.

Step 8050 ends a loop which sums the age cohorts in each color group in order to determine the total population in each color group. TOTAL1 means 1960 white population, TOTAL2 means 1960 nonwhite population, TOTAL3 includes projected 1970 whites, TOTAL4 includes projected 1970 nonwhites.

Step 172 tests to see if nonwhites represented 10 percent or more of the 1960 population. If not, nonwhites are not projected separately.

Step 174 tests for nonwhite representation of 10 percent or more of the projected 1970 population. If not, nonwhites are not projected separately.

Step 175 defines the total population in each age cohort as equal to the sum of the white population. This step is used when the nonwhite population is not projected separately.
The nonwhite population in each age-sex cohort is added to the white population to obtain the total.

FROM THIS POINT TO STEP 311, THE 1980 POPULATION AND LABOR FORCE PROJECTION PROGRAM IS IDENTICAL TO THE 1970 POPULATION AND LABOR FORCE PROJECTIONS PROGRAM. REFER TO THE EXPLANATIONS OF THAT PROGRAM FOR COMPLETE DETAILS OF THE ACTUAL PROJECTION COMPUTATIONS.

NOTE: The discount rates used in projecting the 1980 population apply to groups which were 20 years older than they were in 1960. Therefore, the discount rates are computed by AGEx (I+2) instead of AGEx (I+1), as in the 1970 projections.

Step 311 (page 87) The method of punching the output in the 1980 projections is different from the method used in the 1970 projections.

Step 5000 through 5003 give the formats for the punching of the column headings of certain groups which are given with each step. This explanation is a little more specific than it was with the 1970 projections. In Step 5005 (which ends a loop) that loop punches the Census populations, the discount ratios, and the migration rates. The discount ratios and migration rates are punched for each of the age-sex groups, while the populations (IXAGE(I,1 or 2)) are for color groups.

Step 5011 The loop ending with this step punches the total population (probably the projected 1980 population) for the four color-sex categories (taking the two male categories, than the female categories) and the total populations of males and females, for the ^{i}th age group. Then the total populations for each of the four color-sex categories and the total populations of males and females are punched.

Step 5014 The loop ending in this step punches (IXAGE(II, 1 or 2)) which are Census populations, and punches the male and female labor forces for 1960, 1970, and 1980 (denoted by XMLF or XFLF (0, 1, 2 for 1960, 1970, and 1980, respectively)), and the total number of males and females in the labor force for each of the six age groups. Then the total number of males and females in the labor force for each of these three years is punched. The employment rates and the county number and name are then punched.

Step 5016 through 8001 are formats for the punching of the projected age-sex-color characteristics of the 1980 population.

Step 8060 The loop ending in this step punches the 1980 projected population for each county by age-sex-color group. Then the age-sex-color composition of the labor force is punched for both males and females. This is the last active step in the program.
NOTE: All the steps listed after Step 8060 in the program are concerned with the derivation of alternate migration rate adjustment factors in order to bring the population and labor force in line with projected employment. Consult the methodology and the 1970 program explanations for further details.

Even though these steps are printed in the program after Step 8060, they are concerned with processes that take place before the punching of data.

The computer program for these projections follows:

```
DIMENSION XMLFO(6), FLFO(6), XMPR1(6),FPR1(6),XMPR2(6),
   FPR2(6)
DIMENSION AGE1(16), AGE2(16), AGE3(16), AGE4(16),
   AGE5(16)
DIMENSION RM1(14), RM2(14), RM3(14), RM4(14),RMIG1(14)
DIMENSION RMIG2(14), RMIG3(14),RMIG4(14),POP1(16),
   POP2(16)
DIMENSION POP3(16),POP4(16)
DIMENSION AGE6(16)
DIMENSION AMIG1(14),AMIG3(14)AMIG2(14),AMIG4(14)
DIMENSION OMIG1(14),OMIG2(14),OMIG3(14),OMIG4(14)
DIMENSION XMAXF(6)
DIMENSION XMPR(6),FPR(6)
DIMENSION XMPRP(6), FPRP(6)
DIMENSION SPRM(15)
DIMENSION XMLP1(6),FLP1(6)
DIMENSION XMLP2(6),FLP2(6)
DIMENSION POPM(16),POPF(16)
DIMENSION XMLF1(6),FLF1(6)
DIMENSION XMLF2(6),FLF2(6)
DIMENSION NAME(5),IXAGE(22,2)
```

```
            READ 5020,((IXAGE(I,II),II=1,2),I=1,22)
 5020       FORMAT(40I2)
 8000       FORMAT (8X,6F12.0)
 8002       FORMAT (6X,12F5.2)
    1       FORMAT (I1,14F3.3)
    6       FORMAT (1X,I2,5A2)
    7       FORMAT (I2,I1,I1,13F5.0)
    8       FORMAT (I2,I1,I1,3F5.0,F6.0)
   24       FORMAT (7F2.2)
   25       FORMAT (I1,11F6.4)
   26       FORMAT (I2,I1,6F5.0,F7.0)
   42       FORMAT (12F5.4)
   56       FORMAT (I2,4F8.0)
   57       READ 24,XMAXM
   59       READ 25, ICODE1,(SPRM(I),I=1,11)
   60       READ 25, ICODE2,(SPRM(I),I=12,15)
   62       READ 1, ICODE, (RM1(I), I=1,14)
  451       READ 1, ICODE, (RM2(I), I=1,14)
  453       READ 1, ICODE, (RM3(I), I=1,14)
  455       READ 1, ICODE, (RM4(I), I=1,14)
  461       READ 6, ICTYNR,NAME
            IF(ICTYNR-99)63,400,400
   63       CONTINUE
            DO 6701 I=1,14
            DR2(I)=0.0
            DR4(I)=0.0
            RMIG2(I)=0.0
 6701       RMIG4(I)=0.0
            DO 5700 I=1,16
            POP2(I)=0.0
            POP4(I)=0.0
 5700       CONTINUE
            N=1
            M=6
            DO 8010 IX=1,3
            READ 8000, (AGE1(I),I=N,M)
            READ 8000, (AGE2(I),I=N,M)
            READ 8000, (AGE3(I),I=N,M)
            READ 8000, (AGE4(I),I=N,M)
            N=N+6
            M=M+6
            IF(M-12)8010,8010,8011
 8011       M=16
 8010       CONTINUE
```

```
          N=1
          M=6
          DO 8020 IX=1,3
          READ 8000, (AGE5(I),I=N,M)
          READ 8000, (AGE6(I),I=N,M)
          READ 8000, (AGE7(I),I=N,M)
          READ 8000, (AGE8(I),I=N,M)
          N=N+6
          M=M+6
          IF(M-12)8020,8020,8021
8021      M=16
8020      CONTINUE
          READ 8000, (XMLFO(I),I=1,6)
          READ 8000, (FLFO(I),I=1,6)
          READ 8000, (XMLF1(I),I=1,6)
          READ 8000, (FLF1(I),I=1,6)
          READ 8000, CE1, CE2, EE1, EE2
          READ 8002, (XMPR1(I),I=1,6),(FPR1(I),I=1,6)
          READ 8002, (XMPR2(I),I=1,6), (FPR2(I),I=1,6)
          READ 8002, RATEO
          TOTAL1=0.0
          TOTAL2=0.0
          TOTAL3=0.0
          TOTAL4=0.0
          DO 8050 I=1,16
          TOTAL1=AGE1(I)+TOTAL1
          TOTAL2=AGE2(I)+TOTAL2
          TOTAL3=AGE3(I)+TOTAL3
8050      TOTAL4=AGE4(I)+TOTAL4
 172      TOTPOP=TOTAL1+TOTAL2
          PERCNT=TOTAL2/TOTPOP
          INDIC=0
          IF (PERCNT-.1)174,173,173
 173      INDIC=1
          GO TO 176
 174      TOTPOP=TOTAL3+TOTAL4
          PERCNT=TOTAL4/TOTPOP
          IF (PERCNT-.1)175,173,173
 175      DO 177 I=1,16
          AGE1(I)=AGE1(I)+AGE2(I)
          AGE3(I)=AGE3(I)+AGE4(I)
          AGE5(I)=AGE5(I)+AGE6(I)
 177      AGE7(I)=AGE7(I)+AGE8(I)
 176      DO 178 I=1,13
          DR1(I)=AGE1(I+2)/AGE5(I)
 178      DR3(I)=AGE3(I+2)/AGE7(I)
          TOT=0.0
          TOT=AGE5(14)+AGE5(15)+AGE5(16)
          DR1(14)=AGE1(16)/TOT
          TOT=0.0
          TOT=AGE7(14)+AGE7(15)+AGE7(16)
          DR3(14)=AGE3(16)/TOT
          IF(INDIC-1)181,179,179
 179      DO 180 I=1,13
          DR2(I)=AGE2(I+2)/AGE6(I)
 180      DR4(I)=AGE4(I+2)/AGE8(I)
          TOT=0.0
          TOT=AGE6(14)+AGE6(15)+AGE6(16)
          DR2(14)=AGE2(16)/TOT
          TOT=0.0
          TOT=AGE8(14)+AGE8(15)+AGE8(16)
          DR4(14)=AGE4(16)/TOT
          TOT=0.0
 181      DO 182 I=1,14
          RMIG1(I)=DR1(I)-RM1(I)
          RMIG3(I)=DR3(I)-RM3(I)
          OMIG1(I)=RMIG1(I)
 182      OMIG3(I)=RMIG3(I)
1903      IF(INDIC-1)1904,191,191
 191      DO 192 I=1,14
          RMIG2(I)=DR2(I)-RM2(I)
          RMIG4(I)=DR4(I)-RM4(I)
          OMIG2(I)=RMIG2(I)
 192      OMIG4(I)=RMIG4(I)
1904      SMIG1=0.0
          SMIG3=0.0
          DO 1821 I=1,14
          SMIG1=RMIG1(I)+SMIG1
1821      SMIG3=RMIG3(I)+SMIG3
          IF(SMIG1-0.0)1822,1823,1823
1822      JWM=0
          GO TO 1826
1823      JWM=1
1826      IF(SMIG3-0.0)1824,1825,1825
1824      JWF=0
          GO TO 1827
1825      JWF=1
```

```
1827  SMIG2=0.0
      SMIG4=0.0
      IF(INDIC-1)1926,1828,1828
1828  DO 1921 I=1,14
      SMIG2=RMIG2(I)+SMIG2
1921  SMIG4=RMIG4(I)+SMIG4
      IF(SMIG2-0.0)1922,1923,1923
1922  JNM=0
      GO TO 1929
1923  JNM=1
1929  IF(SMIG4-0.0)1924,1925,1925
1924  JNF=0
      GO TO 1926
1925  JNF=1
1926  SMIG=SMIG1+SMIG3+SMIG2+SMIG4
      IF(SMIG-0.0)1927,1928,1928
1927  JT=0
      GO TO 1881
1928  JT=1
1881  NG=0
      N=0
      K=0
      J=0
      IND=0
 183  X=1.00
      GO TO 190
 184  X=0.75
      GO TO 190
 185  X=0.50
      GO TO 190
 186  X=0.25
      GO TO 190
 187  X=0.00
      GO TO 190
 188  X=1.25
      GO TO 190
 189  X=1.50
      GO TO 190
 190  Y=2.00-X
1901  IF(NG-1)193,1902,1902
1902  Y=1.00+X
      IF(JT-0)193,193,1905
1905  X=-X
      Y=-Y
 193  DO 205 I=1,13
      IF(JWM-1)194,195,195
 194  AMIG1(I)=-RMIG1(I)
      GO TO 1951
 195  AMIG1(I)=RMIG1(I)
1951  IF(JT-JWM)1952,196,1952
1952  TEMP=X
      X=Y
      Y=TEMP
 196  IF(AMIG1(I)-0.0)198,197,197
 197  POP1(I+2)=AGE1(I)*(RM1(I)+X*(OMIG1(I)))
      GO TO 1980
 198  POP1(I+2)=AGE1(I)*(RM1(I)+Y*(OMIG1(I)))
1980  IF(JT-JWM)1981,199,1981
1981  TEMP=X
      X=Y
      Y=TEMP
 199  IF(JWF-1)200,201,201
 200  AMIG3(I)=-RMIG3(I)
      GO TO 2011
 201  AMIG3(I)=RMIG3(I)
2011  IF(JT-JWF)2022,202,2022
2022  TEMP=X
      X=Y
      Y=TEMP
 202  IF(AMIG3(I)-0.0)204,203,203
 203  POP3(I+2)=AGE3(I)*(RM3(I)+X*(OMIG3(I)))
      GO TO 2040
 204  POP3(I+2)=AGE3(I)*(RM3(I)+Y*(OMIG3(I)))
2040  IF(JT-JWF)2041,205,2041
2041  TEMP=X
      X=Y
      Y=TEMP
 205  CONTINUE
      TOT=AGE1(14)+AGE1(15)+AGE1(16)
      IF(JWM-1)206,207,207
 206  AMIG1(14)=-RMIG1(14)
      GO TO 2070
 207  AMIG1(14)=RMIG1(14)
2070  IF(JT-JWM)2071,208,2071
2071  TEMP=X
      X=Y
      Y=TEMP
 208  IF(AMIG1(14)-0.0)210,209,209
 209  POP1(16)=TOT*(RM1(14)+X*(OMIG1(14)))
      GO TO 2100
 210  POP1(16)=TOT*(RM1(14)+Y*(OMIG1(14)))
2100  IF(JT-JWM)2101,211,2101
2101  TEMP=X
      X=Y
      Y=TEMP
 211  TOT=AGE3(14)+AGE3(15)+AGE3(16)
      IF(JWF-1)212,213,213
 212  AMIG3(14)=-RMIG3(14)
      GO TO 2130
 213  AMIG3(14)=RMIG3(14)
2130  IF(JT-JWF)2141,214,2141
2141  TEMP=X
      X=Y
      Y=TEMP
 214  IF(AMIG3(14)-0.0)216,215,215
 215  POP3(16)=TOT*(RM3(14)+X*(OMIG3(14)))
      GO TO 2150
 216  POP3(16)=TOT*(RM3(14)+Y*(OMIG3(14)))
2150  IF(JT-JWF)2161,217,2161
2161  TEMP=X
      X=Y
      Y=TEMP
 217  TOT=0.0
      JND=0
      TOT1=0.0
      TOT2=0.0
      DO 218 I=4,10
      TOT1=TOT1+AGE3(I)
 218  TOT2=TOT2+POP3(I)
      RATIO=TOT2/TOT1
      POP1(1)=AGE1(1)*RATIO
      POP1(2)=AGE1(2)*RATIO
      POP3(1)=AGE3(1)*RATIO
      POP3(2)=AGE3(2)*RATIO
      IF(INDIC-1)247,219,219
 219  DO 231 I=1,13
      IF(JNM-1)220,221,221
 220  AMIG2(I)=-RMIG2(I)
      GO TO 2220
 221  AMIG2(I)=RMIG2(I)
2220  IF(JT-JNM)2211,222,2211
```

```
2211  TEMP=X
      X=Y
      Y=TEMP
 222  IF(AMIG2(I)-0.0)224,223,223
 223  POP2(I+2)=AGE2(I)*(RM2(I)+X*(OMIG2(I)))
      GO TO 2240
 224  POP2(I+2)=AGE2(I)*(RM2(I)+Y*(OMIG2(I)))
2240  IF(JT-JNM)2241,225,2241
2241  TEMP=X
      X=Y
      Y=TEMP
 225  IF(JNF-1)226,227,227
 226  AMIG4(I)=-RMIG4(I)
      GO TO 2280
 227  AMIG4(I)=RMIG4(I)
2280  IF(JT-JNF)2281,228,2281
2281  TEMP=X
      X=Y
      Y=TEMP
 228  IF(AMIG4(I)-0.0)230,229,229
 229  POP4(I+2)=AGE4(I)*(RM4(I)+X*(OMIG4(I)))
      GO TO 2300
 230  POP4(I+2)=AGE4(I)*(RM4(I)+Y*(OMIG4(I)))
2300  IF(JT-JNF)2301,231,2301
2301  TEMP=X
      X=Y
      Y=TEMP
 231  CONTINUE
      TOT=AGE2(14)+AGE2(15)+AGE2(16)
      IF(JNM-1)232,233,233
 232  AMIG2(14)=-RMIG2(14)
      GO TO 2330
 233  AMIG2(14)=RMIG2(14)
2330  IF(JT-JNM)2341,234,2341
2341  TEMP=X
      X=Y
      Y=TEMP
 234  IF(AMIG2(14)-0.0)236,235,235
 235  POP2(16)=TOT*(RM2(14)+X*(OMIG2(14)))
      GO TO 2360
 236  POP2(16)=TOT*(RM2(14)+Y*(OMIG2(14)))
2360  IF(JT-JNM)2361,237,2361
2361  TEMP=X
      X=Y
      Y=TEMP
 237  TOT=AGE4(14)+AGE4(15)+AGE4(16)
      IF(JNF-1)238,239,239
 238  AMIG4(14)=-RMIG4(14)
      GO TO 2400
 239  AMIG4(14)=RMIG4(14)
2400  IF(JT-JNF)2401,240,2401
2401  TEMP=X
      X=Y
      Y=TEMP
 240  IF(AMIG4(14)-0.0)242,241,241
 241  POP4(16)=TOT*(RM4(14)+X*(OMIG4(14)))
      GO TO 2420
 242  POP4(16)=TOT*(RM4(14)+Y*(OMIG4(14)))
2420  IF(JT-JNF)2421,243,2421
2421  TEMP=X
      X=Y
      Y=TEMP
 243  DO 244 I=4,10
      TOT1=TOT1+AGE4(I)
 244  TOT2=TOT2+POP4(I)
      RATIO=TOT2/TOT1
      POP2(1)=AGE2(1)*RATIO
      POP2(2)=AGE2(2)*RATIO
      POP4(1)=AGE4(1)*RATIO
      POP4(2)=AGE4(2)*RATIO
 247  TPOP1=0.
      TPOP2=0.
      TPOP3=0.
      TPOP4=0.
      TPOPM=0.0
      TPOPF=0.0
      DO 248 I=1,16
      POPM(I)=POP1(I)
      POPF(I)=POP3(I)
      TPOP1=TPOP1+POP1(I)
 248  TPOP3=TPOP3+POP3(I)
      IF(INDIC-1)254,249,249
 249  DO 251 I=1,16
      TPOP2=TPOP2+POP2(I)
      TPOP4=TPOP4+POP4(I)
      POPM(I)=POP1(I)+POP2(I)
      POPF(I)=POP3(I)+POP4(I)
      TPOPM=POPM(I)+TPOPM
```

```
251   TPOPF=POPF(I)+TPOPF
254   TPOP=0.
      TPOP=TPOP1+TPOP3+TPOP2+TPOP4
      PM14=0.0
      PF14=0.0
      PM18=0.0
      PF18=0.0
      PM19=0.0
      PF19=0.0
      DO 302 I=1,5
      PM14=POPM(I)*SPRM(I)+PM14
      PF14=POPF(I)*SPRM(I)+PF14
      PM18=POPM(I+1)*SPRM(I+5)+PM18
      PF18=POPF(I+1)*SPRM(I+5)+PF18
      PM19=POPM(I+1)*SPRM(I+10)+PM19
302   PF19=POPF(I+1)*SPRM(I+10)+PF19
      XMLP2(1)     = POPM(4)+PM14-PM18-PM19
      FLP2(1)      = POPF(4)+PF14-PF18-PF19
      XMLP2(2)     = POPM(5)+PM18+PM19
      FLP2(2)      = POPF(5)+PF18+PF19
      XMLP2(3)     = POPM(6)+POPM(7)
      FLP2(3)      = POPF(6)+POPF(7)
      XMLP2(4)     = POPM(8)+POPM(9)
      FLP2(4)      = POPF(8)+POPF(9)
      XMLP2(5)     = POPM(10)+POPM(11)+POPM(12)+POPM(13)
      FLP2(5)      = POPF(10)+POPF(11)+POPF(12)+POPF(13)
      XMLP2(6)     = POPM(14)+POPM(15)+POPM(16)
      FLP2(6)      = POPF(14)+POPF(15)+POPF(16)
303   DO 305 I=1,6
      XMPRP(I)=(XMPR2(I)**2)/XMPR1(I)
305   FPRP(I)=(FPR2(I)**2)/FPR1(I)
      IF(XMPRP(3)-XMAXM)307,307,306
306   XMPRP(3)=XMAXM
307   TMLF2=0.0
      TFLF2=0.0
      TMLF0=0.0
      TFLF0=0.0
      TMLF1=0.0
      TFLF1=0.0
      DO 308 I=1,6
      XMLF2(I)=XMLP2(I)*XMPRP(I)
      FLF2(I)=FLP2(I)*FPRP(I)
      TMLF0=XMLF0(I)+TMLF0
      TFLFO=FLFO(I)+TFLFO
      TMLF1=XMLF1(I)+TMLF1
      TFLF1=FLF1(I)+TFLF1
      TMLF2=XMLF2(I)+TMLF2
 308  TFLF2=FLF2(I)+TFLF2
      TPLF=TMLF2+TFLF2
      RATE=EE2/TPLF
      IF(SENSE SWITCH1)7099,7100
7099  TYPE 7101, RATE,JT,X,NG
      K=9
7101  FORMAT (F8.3,I4,F8.3,I4)
      IF(SENSE SWITCH2)7102,7100
7103  FORMAT (F10.0)
7102  ACCEPT 7103,X
      GO TO 190
7100  IF(RATE-.96)310,310,3121
 310  IF(RATE-.90)3122,311,311
 311  CONTINUE
      PUNCH 5000,ICTYNR,NAME
5000  FORMAT (1H1,I2,5A2)
      PUNCH 5001
5001  FORMAT (1H0, 10X,25H1960-1970 DISCOUNT RATIOS, 16X,25H1960-
         1970 MIGRATION RATES)
      PUNCH 5002
5002  FORMAT (2X,3HAGE,9X,5HWHITE,9X,9HNON-WHITE,17X,5HWHITE,
         9X,9HNON-WHITE) Note:  Last five characters on separate card.
      PUNCH 5003
5003  FORMAT (6H GROUP,5X,4HMALE,3X,6HFEMALE,3X,4HMALE,3X,
         6HFEMALE,11X,4
      1HMALE,3X,6HFEMALE,3X,4HMALE,3X,6HFEMALE,/)
      DO 5004 I=1,14
      PUNCH 5005,IXAGE(I,1),IXAGE(I,2),DR1(I),DR3(I),DR2(I),DR4(I),
         RMIG1
      1(I),RMIG3(I),RMIG2(I),RMIG4(I)
5005  FORMAT (I3, 1H-,I2,2X,4F8.3,8X,4F8.3)
5004  CONTINUE
      PUNCH 5701
5701  FORMAT (9H AND OVER)
      PUNCH 7000,ICTYNR,NAME
7000  FORMAT (1H0/1H0,I2,5A2)
      PUNCH 5006,TPOP,TPLF,EE2
5006  FORMAT (27H 1980 PROJECTED POPULATION=,F8.0,14H
      LABOR FORCE=,F8.0
      1,13H EMPLOYMENT=,F8.0)
      PUNCH 5007,X
```

```
5007  FORMAT (6X,33HMIGRATION RATE ADJUSTMENT FACTOR=,F5.2)
      PUNCH 5008
5008  FORMAT (1H0,24X,29HESTIMATED POPULATION FOR 1980)
      PUNCH 5009
5009  FORMAT (5H AGE,9X,5HWHITE,9X, 9HNON-WHITE,12X,5HTOTAL)
      PUNCH 5010
5010  FORMAT (6H GROUP,5X,4HMALE,3X,6HFEMALE,3X,4HMALE,3X,
         6HFEMALE,5X,4H
      1 MALE, 5X,6HFEMALE,/)
      DO 5011 I=1,16
      PUNCH 5012,IXAGE(I,1),IXAGE(I,2),POP1(I),POP3(I),POP2(I),
         POP4(I),POPM(I),POPF(I)
5012  FORMAT (I3,1H-,I2,2X,4F8.0,2F10.0)
5011  CONTINUE
      PUNCH 5013, TPOP1, TPOP3, TPOP2, TPOP4, TPOPM, TPOPF
5013  FORMAT (6HOTOTAL,2X,4F8.0,2F10.0)
      PUNCH 5000,ICTYNR,NAME
      PUNCH 5500
      PUNCH 5501
      PUNCH 5502
      DO 5014 I=1,6
      II=I+16
      PUNCH 5503,IXAGE(II,1),IXAGE(II,2),XMLFO(I),XMLF1(I),
         XMLF2(I),FLFO(I),FLF1(I),FLF2(I)
5014  CONTINUE
      PUNCH 5504, TMLFO,TMLF1,TMLF2,TFLFO,TFLF1,TFLF2
      PUNCH 5505
      PUNCH 5506
      PUNCH 5507, CE1, CE2, EE1, EE2, RATEO,  RATE
      PUNCH 7000,ICTYNR,NAME
      PUNCH 5508
      PUNCH 5509
      PUNCH 5510
      DO 5016 I=1,6
      II=I+16
      PUNCH 5511,IXAGE(II,1),IXAGE(II,2),XMPR1(I),XMPR2(I),
         XMPRP(I),FPR1(I),FPR2(I),FPRP(I)
5016  CONTINUE
5508  FORMAT (1H0,17X,19HPARTICIPATION RATES)
5509  FORMAT (1H,1X,3HAGE,10X,4HMALE,15X,6HFEMALE)
5510  FORMAT (1H, 5HGROUP,1X,2(2X,4H1960,2X,4H1970,2X,4H1980,2X))
5511  FORMAT (I3,1H-,I2,1X,6F6.2)
5500  FORMAT (1H0,32X,11HLABOR FORCE)
```

```
5501  FORMAT (1H,1X,3HAGE,21X,4HMALE,26X,6HFEMALE)
5502  FORMAT (1H,5HGROUP,4X,2(6X,4H1960,6X,4H1970,6X,4H1980))
5503  FORMAT (I3,1H-,I2,4X,6F10.0)
5504  FORMAT (1H0,5HTOTAL,4X,3F10.0,10X,3F10.0)
5505  FORMAT (1H0,7X,10HEMPLOYMENT,8X,15HEST.EMPLOYMENT, 4X,
         15HEMPLOYMENT RATE)
5506  FORMAT (1H, 5X,4H1950,6X,4H1960,6X,4H1970,6X,4H1980,6X,
         4H1970,6X,4
         H1980)
5507  FORMAT (1H,1X,4(2X,F8.0),2X,2(F5.2,5X))
8001  FORMAT (1H9,I2,I1,I2,I1,I1,6F12.0)
      LND=0
      ICATG=0
      IYR80=4
      IWM=1
      INWM=2
      IWF=3
      INWF=4
      N=1
      M=6
      LND=LND+1
      ICATG=ICATG+1
      DO 8060 IX=1,3
      PUNCH 8001,ICTYNR,ICATG,IYR80,IWM,LND,(POP1(I),I=N,M)
      PUNCH 8001, ICTYNR,ICATG,IYR80,INWM,LND,(POP2(I),I=N,M)
      PUNCH 8001,ICTYNR,ICATG,IYR80,IWF,LND,(POP3(I),I=N,M)
      PUNCH 8001,ICTYNR,ICATG,IYR80,INWF,LND,(POP4(I),I=N,M)
      N=N+6
      M=M+6
      IF(M-12)8060,8060,8061
8061  M=16
8060  CONTINUE
      LND=0
      IM=1
      IF=2
      ICATG=ICATG+1
      PUNCH 8001, ICTYNR,ICATG,IYR80,IM,LND,(XMLF2(I),I=1,6)
      PUNCH 8001,ICTYNR,ICATG,IYR80,IF,LND,(FLF2(I),I=1,6)
      GO TO 461
3121  J=1
      GO TO 312
3122  J=2
 312  IF(IND-1)313,189,313
 313  N=N+1
      GO TO (314,315),N
 314  RATE1=RATE
      GO TO 184
 315  GO TO (3151,3152),J
3151  IF(RATE1-RATE)323,316,316
3152  IF(RATE-RATE1)323,316,316
 316  N=1
      RATE1=RATE
      K=K+1
      GO TO (185,186,187,317,185,184,183,188,189,7099),K
 317  NG=1
 321  DO 322 I=1,14
      OMIG1(I)=ABSF(RMIG1(I))
      OMIG2(I)=ABSF(RMIG2(I))
      OMIG3(I)=ABSF(RMIG3(I))
 322  OMIG4(I)=ABSF(RMIG4(I))
      GO TO 186
 323  IND=1
      GO TO 188
 400  STOP
      END
```

Population And Labor Force Accumulations Program

This program reads the projected population and labor force for 1970 and 1980 for each county, combines them, and punches out a projected population and labor force for a multi-county region. A region of any size up to about 35 counties can be projected in one run of the program. The method of designating the counties in the region is described in the explanation of the program.

The population and labor force accumulations program receives input from the 1970 and 1980 population and labor force projections programs. Its output is produced solely in the form of punched cards for printing, and is in the same format as that in the population and labor force projections programs. This program is the last one in the population and labor force projections group.

Steps 1-9	Format statements
Step 28	ends a loop which assigns storage for the population array. I=years. 1 is 1950, 2 is 1960, 3 is 1970, 4 is 1980. K=1, 17 equals the number of age groups in the population (16) plus a total. (J) means sex groups.
Step 29	ends a loop which assigns storage for the labor force array. The letter (I) also indicates years. The labor force figures involve only three years; 1960, 1970, 1980. Therefore I=1,3. K=1,7 means the age groups (the six groups used in labor force calculations plus a total figure.) (J) indicates sex groups. IND=0 is a counter which is initialized at this point.

The first Read statement reads in something that relates to the labor force array. The second Read statement reads in the numbers of the counties to be processed.

> NOTE: A special card must be placed before the input data cards with the number of the counties in the region (for example, 5) and the specific numbers of the counties in the region (for example, 5, 35, 38, 47 and 83.) This card instructs the computer how many and what counties are to be processed by the program.

Step 140	starts a loop which reads the population figures by age and sex for 1950, 1960, 1970 and 1980. If the county number equals 99 (A card with a 99 punched in columns 79-80 must be placed behind the input deck). The program begins to punch output. Otherwise the program continues.
Step 60	starts a loop which defines two order sequencers relative to the population accumulation (denoted by (NX) and (M), respectively). Step 403 limits (M), which may have some relation to the age groups, to 16, the number of age groups in the population distribution.
Step 42	ends a loop which reads in the labor force age-sex data for each county. It also reads the county number. If the county number reaches 96, the output data are punched. Otherwise, the program continues.
Step 111	starts a loop which determines whether the county being read is one of those to be processed. If it is, the program proceeds to Step 17 and computation begins. If it is not, Step 13 leads to the reading of data for the next county in the input deck (which is output of the population and labor force projections program.)
Step 17	sums the population data by color and age for 1950, 1960, 1970, and 1980. The white population is treated first; the nonwhite population is summed next. 1= white males, 2=white females, 3=white total.
Step 43	3=nonwhite males, 4=nonwhite females, 6=nonwhite totals. K=the 16 age groups, I=Census years listed above.
Step 45	ends a loop which accumulates labor force data. I=the three years, 1960, 1970 and 1980. J=the two sex groups; K=the six age groups. The population and labor force data are added to the previous total.

Steps 170 and 180 are check procedures to determine whether the last county in the output deck, (Step 170) or the last county in the group for which an accumulation is desired (Step 180) has been read. If it has, output is punched. If not, the next county is read.

Step 101 punches according to the format in Statement 1. It is apparently a technical requirement of the program which does not seem to relate directly to the data processing.

Step 44 ends a loop which sums the population data for each of the four years be color and age group. This yields the regional total.

Step 46 sums the labor force for 1960, 1970 and 1980 by sex and age group, and produces the regional labor force totals.

Step 33 punches the accumulated population for the region. Titles listed in the format statements at the beginning of the program that relate to the population accumulations are apparently punched at this point. Population is accumulated by color group. One of these steps (33 and 34) punches white totals, the other nonwhite totals.

Step 34 punches the accumulated white population totals. Various titles relating to the labor force accumulations are punched.

Step 32 starts a loop in which the labor force accumulations are punched. This step completes the program.

The Computer Program for these projections follows:

Program To Accumulate Total For Population And Labor Force 1950, 60, 70, 80

```
1     FORMAT (1H1/1H0)
2     FORMAT (5H AGE, 11X, 4H1970, 16X, 4H1980)
3     FORMAT (6H GROUP, 8X, 4HMALE, 4X, 6HFEMALE, 6X,
         4HMALE, 4X, 6HFEMALE)
```

```
  4     FORMAT (I3, 1H-,I2,2X,4F10.0)
  5     FORMAT (6HOTOTal,2X,4F10.0)
  6     FORMAT (1HO/1HO)
  7     FORMAT (1H,31X,11HLABOR FORCE)
  8     FORMAT (5H AGE,21X,4HMALE,26X,6HFEMALE)
  9     FORMAT (6H GROUP,4X,2(6X,4H1960,6X,4H1970,6X,4H1980)
109     FORMAT (I3,1H-,I2,4X,6F10.0)
 10     FORMAT (6HOTOTAL,4X,6F10.0)
 11     FORMAT (40I2)
 40     FORMAT (1X,I2,5X,6F12.0)
 12     FORMAT (5H AGE,11X,4H1950,16X,4H1960)
        DIMENSION POP(4,6,17),XLF(3,4,7),IXAGE(32,2)
        DIMENSION LIST (96)
        DO 28 I=1,4
        DO 28 J=1,6
        DO 28 K=1,17
 28     POP(I,J,K)=0.0
        DO 29 I=1,3
        DO 29 J=1,4
        DO 29 K=1,7
 29     XLF(I,J,K)=0.0
        READ 11, ((IXAGE(I,II),II=1,2),I=1,22)
        IND=0
        READ 11,N,(LIST(I),I=1,N)
140     DO 402 I=1,4
        NX=1
        M=6
        DO 401 IX=1,3
        DO 60 J=1,4
        READ 40,ICTYNR,(POP(I,J,K),K=NX,M)
        IF(ICTYNR-99)60,101,60
 60     CONTINUE
        NX=NX+6
        M=M+6
        IF(M-12)402,401,403
403     M=16
401     CONTINUE
402     CONTINUE
        DO 42 I=1,3
        DO 42 J=1,2
 42     READ 40,ICTYNR,(XLF(I,J,K),K=1,6)
125     CONTINUE
        IF(N-96)111,17,111
```

```
111     DO 13 I=1,N
        IF(ICTYNR-LIST(I))13,17,13
 13     CONTINUE
        GO TO 140
 17     DO 43 I=1,4
        DO 43 K=1,16
        POP(I,5,K)=POP(I,1,K)+POP(I,2,K)+POP(I,5,K)
 43     POP(I,6,K)=POP(I,3,K)+POP(I,4,K)+POP(I,6,K)
        DO 45 I=1,3
        DO 45 J=1,2
        DO 45 K=1,6
 45     XLF(I,J+2,K)=XLF(I,J,K)+XLF(I,J+2,K)
        IND=IND+1
        IF(N-96)180,170,180
170     IF(IND-95)140,101,140
180     IF(IND-N)140,101,140
101     PUNCH 1
        DO 44 I=1,4
        DO 44 J=5,6
        DO 44 K=1,16
 44     POP(I,J,17)=POP(I,J,K)+POP(I,J,17)
        DO 46 I=1,3
        DO 46 J=3,4
        DO 46 K=1,6
 46     XLF(I,J,7)=XLF(I,J,K)+XLF(I,J,7)
        PUNCH 12
        PUNCH 3
        DO 33 K=1,16
 33     PUNCH 4,IXAGE(K,1),IXAGE(K,2),POP(4,5,K),POP(4,6,K),
           POP(3,5,K),POP 1(3,6,K)
        PUNCH 5,POP(4,5,17),POP(4,6,17),POP(3,5,17),POP(3,6,17)
        PUNCH 1
        PUNCH 2
        PUNCH 3
        DO 34 K=1,16
 34     PUNCH 4,IXAGE(K,1),IXAGE(K,2),POP(2,5,K),POP(2,6,K),
           POP(1,5,K),POP1(1,6,K)
        PUNCH 5,POP(2,5,17),POP(2,6,17),POP(1,5,17),POP(1,6,17)
        PUNCH 6
        PUNCH 7
        PUNCH 8
        PUNCH 9
        DO 32 K=1,6
        KI=K+16
 32     PUNCH 109,IXAGE(KI,1),IXAGE(KI,2),(XLF(I,3,K),I=1,3),
           (XLF(I,4,K),I
        1=1,3)
        PUNCH 10, (XLF(I,3,7),I=1,3),(XLF(I,4,7),I=1,3)
190     STOP
        END
```

The Industry Combination Program

This program is the first of the five programs which comprise the industrial and occupational projections group. It uses 1950 and 1960 census data on employment by industry group as input. The sole purpose of this program is to combine the 41 industry groups used by the Census into 17 industry groups for further processing by other programs. The output from this program, which is 1950 and 1960 Census data on employment by industry group combined into 17 groups, is then relayed to other programs.

Steps 9 through 79--Format statements

Steps 81 through 92 read in the 1950 industry group data. The industrial lineup read in each of these steps is given below.

ICTY is the county number

ICODE is the code signifying whether employment is males or females.
Both sexes are read according to the same format in 1950 data.
Groups 1 through 12 are "Agriculture" through "Other Durable Goods".
Groups 13 through 24 are "Food and Kindred" through "Utilities".
Groups 25 through 36 are "Wholesale Trade" through "Medical"
Groups 37 through 42 are "Educational Services" through "Not Reported".

The (J-2) statement tests to see if 1950 data is continuing to be read.

Steps 97 through 124 read in the 1960 Census data. Different groups were used for total and female in this Census. For males, the following groups are read (refer, as in 1950, to the last numbers listed in the steps).
Groups 1 through 12-"Agriculture" to "Other Durable Goods".
Groups 13 through 24-"Food and Kindred" to "Wholesale Trade".

Groups 25 through 36-"Food Stores" to "Educational Services-Private".
Groups 37 through 41-"Welfare, etc." to "Not Reported"

For females, the groups are as follows:
Groups 1 through 12-"Agriculture, etc." to "Food Stores"
Groups 13 through 24-"Eating and Drinking Places" to "Not Reported".

Steps 201 and 203 end loops that probably have something to do with setting up the computer to determine 1950 and 1960 data.
EMP1(I,1) denotes 1950 male employment in one of the 19 groups printed by the computer and used in projections.
EMP1(I,2) denotes 1950 female employment in one of the 19 groups.
EMP2(I,3) denotes 1960 total employment in one of the 19 groups.
EMP2(I,2) denotes 1960 female employment in one of the 19 groups.
The number of the group is denoted by (I).

Step 201 treats the 1950 data, step 203 treats the 1960 data.

At this point, the various Census groups and the actual computer groups into which they are combined will be shown. The combination groupings are essential to a complete understanding of the remainder of the program, which actually combines the Census groups into the computer groups and punches the results for use in the industry projections program for 1970 and 1980. One group) "Industry Not Reported", was not printed. Therefore, only reported industries are considered in the other programs.

Combination of 1950 Census Groupings Into Computer Groups (Both Sexes)

Census Groups	Computer Groups
1. Agriculture	1. Agriculture, Forestry Fisheries
2. Forestry and Fisheries	
3. Mining	2. Mining
4. Construction	3. Construction

Census Groups	Computer Groups
5. Furniture, lumber & wood products	4. Durable Manufacturing
6. Primary metals	
7. Fabricated and other metals	
8. Non-electrical machinery	
9. Electrical machinery	
10. Motor vehicles & their equipment	
11. Other transportation equipment	
12. Other durable goods	
13. Food and kindred products	5. Non-Durable Manufacturing
14. Textiles	
15. Apparels and fabricated textiles	
16. Printing and publishing	
17. Chemicals	
18. Other nondurable goods	
19. Unspecified manufacturing industries	
20. Railroads and railway express	6. Transportation and Other Public Utilities
21. Trucking service and warehousing	
22. Other transportation	
23. Telecommunications	
24. Utilities and sanitary services	
25. Wholesale trade	7. Wholesale Trade
26. Food & dairy products stores	8. Food & Dairy Products Stores
27. Eating and drinking places	9. Eating & Drinking Places
28. Other retail trade	10. Other Retail Trade
29. Finance, insurance, real estate	11. Finance, Insurance, Real Estate
30. Business services	12. Business & Repair Service
31. Repair services	
32. Private households	13. Personal Service
33. Hotels and lodging places	
34. Other personal services	
35. Entertainment & recreation service	14. Entertainment & Recreation Services
36. Educational services-government	15. Educational Services
37. Educational services-private	
38. Medical and health services	16. Other Professional and Related Services

39. Other professional and related services	16. Other Professional and Related Services
40. Public administration	17. Public Administration
41. Industry not reported	18. (Not printed)

Combinations of 1960 Census Definitions Into Computer Groups
(Total)

Census Groups	Computer Groups
1. Agriculture	1. Agriculture, Forestry and Fisheries
2. Forestry and Fisheries	
3. Mining	2. Mining
4. Construction	3. Construction
5. Furniture, Lumber & Wood Products	4. Durable Manufactures
6. Primary Metals	
7. Fabricated & Unspecified Metals	
8. Non-Electrical Machinery	
9. Electrical Machinery	
10. Motor Vehicles etc.	
11. Transportation Equipment exc. Motor Vehicles	
12. Other Durable Goods	
13. Food and Kindred Products	5. Non-Durable Manufactures
14. Textiles	
15. Apparel and Fabricated Textiles	
16. Printing and Publishing	
17. Chemicals	
18. Other Nondurable Goods	
19. Railroads and Railway Express	6. Transportation and Other Public Utilities
20. Trucking Service & Warehousing	
21. Communications	
22. Public Utilities & Santiary Service	
23. Other Transportation	
24. Wholesale Trade	7. Wholesale Trade
25. Food Stores	8. Food Stores
26. Eating & drinking places	9. Eating & Drinking Places

27. Other retail trade	10. Other Retail Trade
28. Finance, insurance, and real estate	11. Finance, Insurance and Real Estate
29. Business Services	12. Business and Repair Services
30. Repair Services	
31. Private Households	13. Personal Service
32. Other Personal Services	
33. Entertainment and Recreation Services	14. Entertainment And Recreation Services
35. Educational Services: Government	15. Educational Services
36. Educational Services: Private	
34. Hospitals	16. Other Professional And Related Services
37. Welfare, Religious, and Non-profit Organizations	
38. Other Professional and Related Services	
39. Public Administration	17. Public Administration
40. Industry Not Reported	18. (Not printed)

Combinations of 1960 Census Group Into Computer Groups
(Females)

Census Groups	Computer Groups
1. Agriculture, Forestry and Fisheries	1. Agriculture, Forestry and Fisheries
2. Construction and Mining (NOTE: Mining employment among females was considered to be zero, therefore all females in Census Group 2 were listed in Computer Group 3, CONSTRUCTION.)	2. Construction
3. Machinery	4. Durable Manufactures
4. Transportation Equipment	
5. Other Durable Goods	
6. Food and Kindred Products	5. Nondurable Manufactures
7. Textiles	
8. Apparel & Fabricated Textiles	
9. Other Nondurable Goods and Nonspecified Manufactures	

Census Groups		Computer Groups
10. Transportation, Communications and Public Utilities	→	6. Transportation, Communications and Public Utilities
11. Wholesale Trade	→	7. Wholesale Trade
12. Food and Diary Products Stores	→	8. Food and Dairy Products Stores
13. Eating and Drinking Places	→	9. Eating and Drinking Places
14. Other Retail Trade	→	10. Other Retail Trade
15. Finance, Insurance and Real Estate	→	11. Finance, Insurance and Real Estate
16. Business and Repair Services	→	12. Business and Repair Services
17. Personal Services	→	13. Personal Services
18. Entertainment and Recreation Services	→	14. Entertainment and Recreation Services
20. Educational Services: Government 21. Educational Services: Private	→	15. Educational Services
19. Hospitals 22. Other Professional and Related Services	→	16. Other Professional and Related Services
23. Public Administration	→	17. Public Administration
24. Industry Not Reported	→	18. (Not printed)

The 1950 Census groups are taken from U.S. Census of Population 1950.

The 1960 Census groups are taken from U.S. Census of Population 1960.

The program continues with the actual combination of Census groups into computer groups.

Step 114 does the combination for Computer Group 1, "AGRICULTURE, FORESTRY AND FISHERIES". Each step in this statement will be explained, as it will serve as a model for the other combinations.
EMP1(1,1)=A(1,1,1)+A(2,1,1) establishes 1950 male employment in agriculture, forestry and fisheries by adding 1950 male employment in the two groups, "Agriculture" and "Forestry and Fisheries".

EMP1(1,2)=A(1,2,1)+A(2,2,1) does the same for females in 1950.

EMP2(1,3)=A(1,1,2)+A(2,1,2) determines total employment for 1960 by combining the two Census groups, "Agriculture" and "Forestry and Fisheries".

EMP2(1,2)=A(1,2,2) denotes the number of females employed in 1960 in the computer group "Agriculture, Forestry and Fisheries" as the same as the Census groups of that name.

In all the combination statements, EMP1(i,y)=A(w,x,z)represents 1950 employment.
EMP2(i,y)=A(w,x,z)represents 1960 employment.

(EMP) means Computer Group Character

i=the Computer Group number

y=sex, and EMP1 (i,1) means 1950 males employment in group (i).

EMP1 (i,2) means 1950 females employment in this group.

EMP2 (i,3) means 1960 total employment in this group.

EMP2(i,2) means 1960 females employment in this group.

(A) denotes the Census group character

w=Census group number

A(w,1,1) means 1950 male employment in Census group (w).

A(w,2,1) means 1950 female employment in this group.

A(w,1,2) means 1960 total employment in this group.

A(w,2,2) means 1960 female employment in this group.

There are a number of DO loops in the combination steps. Each of these is explained below.

Step 115 is the combination into 1950 employment in DURABLE MANUFACTURING. Census groups 5 through 12 are combined into Computer group 4.

Step 116 is the combination of Census Groups 13 through 19 into 1950 employment in Computer group 5, NONDURABLE MANUFACTURING.

Step 117 is the combination for 1960 total employment in Computer group 4 DURABLE MANUFACTURING.

Step 118 is the combination for 1960 female employment in Computer group 4 DURABLE MANUFACTURING.

Step 119 is the combination for 1960 total employment in Computer group 5 NONDURABLE MANUFACTURING.

Step 120 is the combination for 1960 female employment in Computer group 5 NONDURABLE MANUFACTURING.

Step 121 is the combination for 1950 male employment in Computer group 6 TRANSPORTATION AND PUBLIC UTILITIES.

Step 122 is the combination for 1950 female employment in this group (For further explanation of these loops see combinations above).

After the combinations are completed, the final step in this program is the production of the output.

Firt the county number and name (ICTYNR and NAME) are punched. This is followed by the punching of the county number and the employment figures for 1950 and 1960 by computer groups. Male employment in 1950 is punched first, followed in order by 1950 female employment, 1960 total employment, and 1960 female employment. The county number and (EE1) and (EE2) are produced last.

The Computer Program for these projections follows:

```
   DIMENSION A(42,2,2),EMP1(18,3),EMP2(18,3),EMP3(18,3),EMP4(18,3)
   DIMENSION NAME(5)
 9 FORMAT (I2,I2,12f6.0)
13 FORMAT (I2,I1,9f7.0)
14 FORMAT (I2,5A2)
29 FORMAT (I2,I6X,2FA.0)
79 READ 14,ICTYNR,NAME
   IF(ICTYNR-99)78,200,78
78 J=1
81 READ 9,ICTY,ICODE,(A(I,J,1),I=1,12)
88 READ 9,ICTY,ICODE,(A(I,J,1),I=13,24)
```

```
 90 READ 9,ICTY,ICODE,(A(I,J,1),I=25,36)
 92 READ 9,ICTY,ICODE,(A(I,J,1),I=37,42)
    J=J+1
    IF(J-2)81,81,97
 97 READ 9,ICTY,ICODE,(A(I,1,2),I=1,12)
 99 READ 9,ICTY,ICODE,(A(I,1,2),I=13,24)
101 READ 9,ICTY,ICODE,(A(I,1,2),I=25,36)
103 READ 9,ICTY,ICODE,(A(I,1,2),I=37,41)
107 READ 9,ICTY,ICODE,(A(I,2,2),I=1,12)
109 READ 9,ICTY,ICODE,(A(I,2,2),I=13,24)
124 READ 29,ICTYNR,EE1,EE2
    DO 201 I=4,6
    EMP1(I,1)=0.0
201 EMP1(I,2)=0.0
    DO 203 I=4,5
    EMP2(I,3)=0.0
203 EMP2(I,2)=0.0
    EMP2(6,3)=0.0
114 EMP1(1,1)=A(1,1,1)+A(2,1,1)
    EMP1(1,2)=A(1,2,1)+A(2,2,1)
    EMP2(1,3)=A(1,1,2)+A(2,1,2)
    EMP2(1,2)=A(1,2,2)
    EMP1(2,1)=A(3,1,1)
    EMP1(2,2)=0.0
    EMP2(2,3)=A(3,1,2)
    EMP2(2,2)=0.0
    EMP1(3,1)=A(4,1,1)
    EMP1(3,2)=A(4,2,1)+A(3,2,1)
    EMP2(3,3)=A(4,1,2)
    EMP2(3,2)=A(2,2,2)
    DO 115 I=5,12
    EMP1(4,1)=A(I,1,1)+EMP1(4,1)
115 EMP1(4,2)=A(I,2,1)+EMP1(4,2)
    DO 116 I=13,19
    EMP1(5,1)=A(I,1,1)+EMP1(5,1)
116 EMP1(5,2)=A(I,2,1)+EMP1(5,2)
    DO 117 I=5,12
117 EMP2(4,3)=A(I,1,2)+EMP2(4,3)
    DO 118 I=3,5
118 EMP2(4,2)=A(I,2,2)+EMP2(4,2)
    DO 119 I=13,18
119 EMP2(5,3)=A(I,1,2)+EMP2(5,3)
    DO 120 I=6,9
```

```
120 EMP2(5,2)=A(I,2,2)+EMP2(5,2)
    DO 121 I=20,24
    EMP1(6,1)=A(I,1,1)+EMP1(6,1)
121 EMP1(6,2)=A(I,2,1)+EMP1(6,2)
    DO 122 I=19,23
122 EMP2(6,3)=A(I,1,2)+EMP2(6,3)
    EMP2(6,2)=A(10,2,2)
    EMP1(7,1)=A(25,1,1)
    EMP1(7,2)=A(25,2,1)
    EMP2(7,3)=A(24,1,2)
    EMP2(7,2)=A(11,2,2)
    EMP1(8,1)=A(26,1,1)
    EMP1(8,2)=A(26,2,1)
    EMP2(8,3)=A(25,1,2)
    EMP2(8,2)=A(12,2,2)
    EMP1(9,1)=A(27,1,1)
    EMP1(9,2)=A(27,2,1)
    EMP2(9,3)=A(26,1,2)
    EMP2(9,2)=A(13,2,2)
    EMP1(10,1)=A(28,1,1)
    EMP1(10,2)=A(28,2,1)
    EMP2(10,3)=A(27,1,2)
    EMP2(10,2)=A(14,2,2)
    EMP1(11,1)=A(29,1,1)
    EMP1(11,2)=A(29,2,1)
    EMP2(11,3)=A(28,1,2)
    EMP2(11,2)=A(15,2,2)
    EMP1(12,1)=A(30,1,1)+A(31,1,1)
    EMP1(12,2)=A(30,2,1)+A(31,2,1)
    EMP2(12,3)=A(29,1,2)+A(30,1,2)
    EMP2(12,2)=A(16,2,2)
    EMP1(13,1)=A(32,1,1)+A(33,1,1)+A(34,1,1)
    EMP1(13,2)=A(32,2,1)+A(33,2,1)+A(34,2,1)
    EMP2(13,3)=A(31,1,2)+A(32,1,2)
    EMP2(13,2)=A(17,2,2)
    EMP1(14,1)=A(35,1,1)
    EMP1(14,2)=A(35,2,1)
    EMP2(14,3)=A(33,1,2)
    EMP2(14,2)=A(18,2,2)
    EMP1(15,1)=A(37,1,1)+A(38,1,1)
    EMP1(15,2)=A(37,2,1)+A(38,2,1)
    EMP2(15,3)=A(35,1,2)+A(36,1,2)
    EMP2(15,2)=A(20,2,2)+A(21,2,2)
    EMP1(16,1)=A(36,1,1)+A(39,1,1)
    EMP1(16,2)=A(36,2,1)+A(39,2,1)
    EMP2(16,3)=A(34,1,2)+A(37,1,2)+A(38,1,2)
    EMP2(16,2)=A(19,2,2)+A(22,2,2)
    EMP1(17,1)=A(40,1,1)
    EMP1(17,2)=A(40,2,1)
    EMP2(17,3)=A(39,1,2)
    EMP2(17,2)=A(23,2,2)
    EMP1(18,1)=A(41,1,1)
    EMP1(18,2)=A(41,2,1)
    EMP2(18,3)=A(40,1,2)
    EMP2(18,2)=A(24,2,2)
    PUNCH 14,ICTYNR,NAME
    K=1
    PUNCH 13,ICTY,K,(EMP1(I,1),I=1,9)
    K=2
    PUNCH 13,ICTY,K,(EMP1(I,1),I=10,18)
    K=3
    PUNCH 13,ICTY,K,(EMP1(I,2),I=1,9)
    K=4
    PUNCH 13,ICTY,K,(EMP1(I,2),I=10,18)
    K=5
    PUNCH 13,ICTY,K,(EMP2(I,3),I=1,9)
    K=6
    PUNCH 13,ICTY,K,(EMP2(I,3),I=10,18)
    K=7
    PUNCH 13,ICTY,K,(EMP2(I,2),I=1,9)
    K=8
    PUNCH 13,ICTY,K,(EMP2(I,2),I=10,18)
    PUNCH 29,ICTYNR,EE1,EE2
    GO TO 79
200 STOP
    END
```

The 1970-1980 Industry Projection Programs

This program projects employment by industry group by sex for 1970 and 1980. These groups are presented in several different ways. The projections are extrapolations of 1950-1960 trends. The relative distribution of employed males and females for each of the computer group industries developed in the combination program is printed. The program yields the relative percentage distribution of employment among industries, the industry distribution in absolute numbers of employed males, employed females, and total employed. The program also gives the relative distribution of male and female employment within industries and for the total employed.

This program is the most important program in the second group of projections. It takes its input from the industry combination program and it has three outputs. One is used for printing, another output is input to the industries accumulation program and the third output is input to the occupational projections program.

Steps 1 and 3 Format statements. Step 1 is for county number and name, Step 3 reads in the punched industry data for the 18 computer group industries which is the output from the combinations program.

Steps 400 through 405 comprise a loop which checks for sequence errors in the cards. If there is no sequence error, the reading of data begins.

Step 20 reads county number and name. A 99 card is placed behind the data cards to stop processing. If there are more than 99 counties in a region to be considered, this number can be changed by inserting a card with a larger number. If ICTYNR=99, program stops.

Step 22 reads in the data which was produced by the combination program. The input data is arranged as follows:

- ICODE1 is 1950 male employment for Computer Groups 1 through 9, "Agriculture, Forestry and Fisheries" through "Eating and Drinking Places".
- ICODE2 is 1950 male employment for Computer Groups 10 through 18, "Other Retail Trade" through "Industry Not Reported".
- ICODE3 is 1950 female employment for Computer Groups 1 through 9.

ICODE4 is 1950 female employment for Computer Groups 10 through 18.

ICODE5 is 1960 total employment for Computer Groups 1 through 9.

ICODE6 is 1960 total employment for Computer Groups 10 through 18.

ICODE7 is 1960 female employment for Computer Groups 1 through 9.

ICODE8 is 1960 female employment for Computer Groups 10 through 18.

It will be noted that the EMP1 or 2(I, 1 or 2 or 3) coding punched into the data cards in the combination program is also read. The meaning of this code is described with the combination program.

Step 29 reads in the 1950 and 1960 employment rates (EE1 and EE2)

Step 43 ends a loop which determines the employment for each of the 18 computer industry groups. First, the 1960 male employment for each industry is determined by subtracting the 1960 female employment for a specific industry from the 1960 total employment for that industry. Second, the 1950 total employment (EMP1) for the industry is determined by summing the 1950 male and 1950 female employments for that industry.

Step 44 starts a loop that determines the employment by sex for each of the first 17 computer industry groups that were developed in the combinations program. The symbol (XEMP(1 and 2)) indicate male employment for 1950 and 1960, respectively. The symbol (FEMP(1 and
Step 45 2)) indicates female employment for 1950 and 1960, respectively. Step 45 ends the loop.

Step 49 ends a loop which determines the relative distribution of total male and female employment in each industry for 1950 and 1960. The symbol (RD1 (I, 1 or 2)) indicates 1950 male or female employment in industry group I. The symbol (RD2(I, 1 or 2)) indicates 1960 male or female employment in industry group I. This relative distribution is expressed in percentage terms Computer industry group 18, "Industry Not Reported" is eliminated from processing at this point because the machine is instructed to process only the first 17 industry groups.

Steps 46 and 47 determine employment for each industry for males and females for 1950 and 1960 by dividing the total male or female employment for those years (EMP18(1 or 2)) by the relative percentage of total employment represented by each of the 17 industry groups (RD 1 or 2 (I, 1 or 2)) with I representing an
(year) (male or female)
industry group.

For some reason, after Step 47 is completed, the program redoes Steps 44, 45 and 49. Then it moves to Step 48, which projects the distribution of employment to 1970.

Steps 48 and 51 comprise a loop which projects the relative distribution of employment of males and females by industry for 1970. (RD3(I,J)) represents projected 1970 percentage of employment by sex group (J) and industry group (I). This percentage is projected by geometric extrapolation, with the projected 1970 percentage equal to the square of the 1960 percentage divided by the 1950 percentage. Within the loop, Step 50 makes special provision if the 1950 percentage of employment happened to be zero.

Step 52 ends a loop which sums the 1970 relative distribution for each industry. These sums are represented by TEMP (1 or 2).

Step 53 ends a loop in which (TEMP1) and (TEMP2) are adjusted to equal 100 percent. (RD3(I, 1 or 2)) are made percentages of (TEMP1) or (TEMP2) respectively. (TEMP1) and (TEMP2) both equal 100 percent.

Step 54 is the last computational step in a loop which projects the 1980 percentages of employment of males and of females represented by the ^{I}th industry group. This loop performs in the same way as the loop ending in Step 51 projected the 1970 percentages. The difference is that the 1980 projections are the quotients of the 1970 projections squared and divided by the 1960 percentages. The projected 1980 percentage is denoted by (RD4(I,J) where (I)=1,2 (sex) and (J)= 1,17 (industry group).

Step 55 sums the 1980 projected percentages of males and females employed in each of the 17 industry groups.

Step 56 adjusts (TEMP1) and (TEMP2) so that they equal 100 percent. It operates in the same way that Step 53 adjusts the 1970 projected percentages.

NOTE: The projected 1970 and 1980 percentages computed above are the percentages of total male or female employment represented by each industry group.

Step 575 ends a loop that determines the percentages of total employment represented by males and by females employed in the ^{I}th industry group in the years 1950 and 1960. Within the loop, Step 571 determines the 1950 percentage. (PI1(I,J)) represents the percentage of total 1950 employment represented by the ^{J}th sex group in the ^{I}th industry. Step 572 sets this percentage at zero if it is determined to be zero. Step 57 performs the same function for the 1960 percentage (PI2(I,J)) as step 571 did for the 1950 percentage. Step 574 determines whether the 1960 percentage was equal to zero. If so, Step 573 defines it as zero.

Step 59 ends a loop which determines the projected 1970 percentages of total employment represented by males or females employed in the ^{I}th industry group. This percentage is denoted by (PI3(I,J)). If the 1950 percentage is zero, Step 58 sets the projected 1970 percentage at the product of 4 multiplied by the quotient of the 1960 percentage divided by 2.

Step 581 If the 1950 percentage is not equal to zero, the projected 1970 percentage is the quotient of the 1960 percentage squared divided by the 1950 percentage.

Step 60 ends a loop which determines the percentage of the projected 1980 labor force represented by males. This has the effect of forcing the sum of the percentage of males and the percentage of females projected for 1970 to equal one.

Steps 591 and 592 In the almost impossible event of the sum of projected male and female employment for 1970 (or the percentages represented by the two sexes) equalling zero, Step 592 defines the projected percentages of both male and female employment as zero. If the sum of the two percentages is not equal to zero, Step 591 defines the percentage of male employment in 1970 as the quotient of the percentage of male employment (PI3(I,1)) divided by the sum of the percentage of male employment for 1970 and the projected percentage of employment in 1970 represented by females (PI3(I,2)). The percentage of total 1970 projected employment represented by females is determined to be 1.0 minus (PI3(I,1)).

Step 62 ends a loop which begins the computation of the projected 1980 industry employment figures. This loop determines the projected 1980 percentage of total male or female employment represented by employment in the ^{I}th industry group. If the 1960 percentage equals zero, Step 61 determines the projected 1980 percentage as the quotient of 4.0 divided by the quotient of the 1970 projected percentage divided by 2.0. If the 1960 percentage was not equal to zero, Step 621 defines the projected 1980 percentage as the quotient of the projected 1970 percentage squared divided by the 1960 percentage.

Step 63 ends a loop which makes the sum of the percentages of males and females employed in industry equal to 100. This is done in the same manner that it was done for the projected 1970 populations in Step 60.

Another major part of the program begins at this point. First the percentages of males and of females in the total employed labor forces for 1950 and for 1960 are determined. Then the projected percentages of males and females in the entire employed labor force for 1970 and 1980 are projected. The symbols are:

PML1 and PFL1=percentages for males and females, 1950
PML2 and PFL2=these percentages for 1960
PML3 and PFL3=these percentages projected for 1970.
PML4 and PFL4=these percentages projected for 1980.

To determine the projected percentage of each sex in all employment for 1970 and 1980, the percentages for each industry group is summed through multiplying the relative distribution of each sex among industries (RD) by the distribution within industries (PI) and adding the products for each of the 17 industry groups.

Step 64 forces both percentages so that the sums of PML3+PFL3 and PML4+PFL4 both equal 1.0. Then these percentages

Step 641 are multiplied by employment rates (EE1 for 1970, EE2 for 1980) to obtain (XEMP3 and 4; male 1970 and 1980) and (FEMP3 and 4; females 1970 and 1980). Step 641 ends this loop.

Step 14-17 are format statements relating to the punching of the relative distribution of employed males and females among industries.

This program moves into its final phase, that of the punching of the output.

Step 13 The first data to be punched are the relative distributions of the employed for each sex for 1950, 1960, 1970, 1980. These show the percentages of the total employed males and females employed in each industry group. Male distributions are punched first; female distributions are punched second. (RD)=symbol

Step 211 The relative distribution of males and females within industries is punched next. The information is punched for each of the four Census years shown in Step 13, with males and females under each year. This gives a quick glance at the historical or the projected percentage of either sex in any of the 17 industry groups. (PI)=symbol

Step 23 is the format for the next output, which is the aggregate relative distribution of employed males and females for each of the four Census years shown in Step 13. This step shows the share of either sex in the total employed labor force. (PML) or (PFL).

Step 27 The industry distribution of employed males and females in absolute numbers is produced next. This was printed on two separate sheets. The absolute number of males and females employed in each of the 17 industry groups for each Census year was printed. (EMP) is the symbol for this group. The next punched output is input into other programs rather than for printing, as was the output produced in the previous steps.

Step 28 (XEMP) and (FEMP) are punched for inclusion into some other program.

Step 501 The actual employment by industry group for males and for females projected for 1970 and for 1980 is punched again into cards with a 9 in column 80 for input into the occupational projections program.

Step 602 The actual employment by industry group for males and for females projected for 1970 and 1980, 1950 and 1960 is punched again into cards with a 99 in columns 79 and 80 for input into the industry accumulation program.

This step is the final step in the populations projections program.

IMPORTANT NOTE

The symbol (RD) refers to the relative distribution of employment of males and females among the industry groups. It tells what percentage of males, for example, are employed in retail trade in 1960.

The symbol (PI) refers to the distribution of employment of males and females within industries. It tells what percentage of all employees in retail trade in 1960 were males, for example.

The symbol (PML) tells what percentage of total employment in 1960 in a given year was represented by males. (PFL) represents percentage of total employed represented by females.

The Computer Program for these projections follows.

```
      DIMENSION EMP1(18,3),EMP2(18,3),EMP3(18,3),EMP4(18,3)
      DIMENSION PI1(18,2),PI2(18,2) PI3(18,2),PI4(18,2)
      DIMENSION RD1(18,2),RD2(18,2),RD3(18,2),RD4(18,2)
      DIMENSION INDUS(17,16)
      DIMENSION NAME(5)
  1   FORMAT (I2,5A2)
  3   FORMAT (I2,I1,9F7.0)
400   N=0
401   FORMAT (I2,16A2)
      DO 405 I=1,17
      READ 401,INDNR,(INDUS(I,J),J=1,16)
402   N=N+1
      IF(INDNR-N)404,405,404
403   FORMAT (32HSEQUENCE ERROR IN INDUSTRY CARDS)
404   TYPE 403
      PAUSE
      GO TO 400
405   CONTINUE
 20   READ1,ICTYNR,NAME
      IF(ICTYNR-99)22,100,22
 22   READ 3,ICTY1,ICODE1,(EMP1(I,1),I=1,9)
      READ 3,ICTY2,ICODE2,(EMP1(I,1),I=10,18)
      READ 3,ICTY1,ICODE3,(EMP1(I,2),I=1,9)
      READ 3,ICTY2,ICODE4,(EMP1(I,2),I=10,18)
      READ 3,ICTY1,ICODE5,(EMP2(I,3),I=1,9)
      READ 3,ICTY2,ICODE6,(EMP2(I,3),I=10,18)
      READ 3,ICTY1,ICODE7,(EMP2(I,2),I=1,9
      READ 3,ICTY2,ICODE8,(EMP2(I,2),I=10,18)
 29   FORMAT (I2,16X,2F8.0)
      READ 29,ICTYNR,EE1,EE2
      DO 43 I=1,18
      EMP2(I,1)=EMP2(I,3)-EMP2(I,2)
43    EMP1(I,3)=EMP1(I,1)+EMP1(I,2)
      N=0
44    N=N+1
      XEMP1=0.0
      FEMP1=0.0
      XEMP2=0.0
      FEMP2=0.0
      DO 45 I=1,17
      XEMP1=EMP1(I,1)+XEMP1
      FEMP1=EMP1(I,2)+FEMP1
      XEMP2=EMP2(I,1)+XEMP2
45    FEMP2=EMP2(I,2)+FEMP2
      DO 49 I=1,17
      RD1(I,2)=EMP1(I,2)/FEMP1
      RD1(I,1)=EMP1(I,1)/XEMP1
      RD2(I,1)=EMP2(I,1)/XEMP2
49    RD2(I,2)=EMP2(I,2)/FEMP2
      GO TO (46,48),N
46    DO 47 I=1,17
      EMP1(I,2)=RD1(I,2)*EMP1(18,2)+EMP1(I,2)
      EMP1(I,1)=RD1(I,1)*EMP1(18,1)+EMP1(I,1)
      EMP2(I,1)=RD2(I,1)*EMP2(18,1)+EMP2(I,1)
      EMP2(I,2)=RD2(I,2)*EMP2(18,2)+EMP2(I,2)
      EMP1(I,3)=EMP1(I,1)+EMP1(I,2)
47    EMP2(I,3)=EMP2(I,1)+EMP2(I,2)
      GO TO 44
48    DO 51 J=1,2
      DO 51 I=1,17
      IF(RD1(I,J)-0.0)551,50,551
50    RD3(I,J)=4.0*(RD2(I,J)/2.0)
      GO TO 51
551   RD3(I,J)=RD2(I,J)**2/RD1(I,J)
51    CONTINUE
      TEMP1=0.0
      TEMP2=0.0
      DO 52 I=1,17
      TEMP1=RD3(I,1)+TEMP1
52    TEMP2=RD3(I,2)+TEMP2
      DO 53 I=1,17
      RD3(I,1)=RD3(I,1)/TEMP1
53    RD3(I,2)=RD3(I,2)/TEMP2
      TEMP1=0.0
      TEMP2=0.0
      DO 542 J=1,2
      DO 542 I=1,17
      IF(RD2(I,J)-0.0)54,541,54
541   RD4(I,J)=0.0
      GO TO 542
 54   RD4(I,J)=(RD3(I,J)**2/RD2(I,J))
542   CONTINUE
      DO 55 I=1,17
      TEMP1=RD4(I,1)+TEMP1
 55   TEMP2=RD4(I,2)+TEMP2
      DO 56 I=1,17
      RD4(I,1)=RD4(I,1)/TEMP1
 56   RD4(I,2)=RD4(I,2)/TEMP2
      TEMP1=0.0
      TEMP2=0.0
      DO 575 J=1,2
      DO 575 I=1,17
      IF(EMP1(I,3)-0.0)571,572,571
572   PI1(I,J)=0.0
      GO TO 574
571   PI1(I,J)=EMP1(I,J)/EMP(I,3)
574   IF(EMP2(I,3)-0.0)57,573,57
573   PI2(I,J)=0.0
      GO TO 575
 57   PI2 (I,J)=EMP2(I,J)/EMP2(I,3)
575   CONTINUE
      DO 59 J=1,2
      DO 59 I=1,17
      IF(PI1(I,J)-0.0)581,58,581
 58   PI3(I,J)=4.0*(PI2(I,J)/2.0)
      GO TO 59
581   PI3(I,J)=PI2(I,J)**2/PI1(I,J)
 59   CONTINUE
      DO 60 I=1,17
      IF(PI3(I,1)+PI3(I,2)-0.0)591,592,591
592   PI3(I,1)=0.0
      PI3(I,2)=0.0
      GO TO 60
591   PI3(I,1)=PI3(I,1)/(PI3(I,1)+PI3(I,2))
      PI3(I,2)=1.0-PI3(I,1)
 60   CONTINUE
      DO 62 J=1,2
      DO 62 I=1,17
      IF(PI2(I,J)-0.0)621,61,621
```

```
621   PI4(I,J)=PI3(I,J)**2/PI2(I,J)
      GO TO 62
 61   PI4(I,J)=4.0*(PI3(I,J)/2.0)
 62   CONTINUE
      DO 63 I=1,17
      IF(PI4(I,1)+PI4(I,2)-0.0)622,624,622
624   PI4(I,1)=0.0
      PI4(I,2)=0.0
      GO TO 63
622   PI4(I,1)=PI4(I,1)/(PI4(I,1)+PI4(I,2))
      PI4(I,2)=1.0-PI4(I,1)
 63   CONTINUE
      PML1=XEMP1/(XEMP1+FEMP1)
      PFL1=1.0-PML1
      PML2=XEMP2/(XEMP2+FEMP2)
      PFL2=1.0-PML2
      PML3=0.0
      PFL3=0.0
      PML4=0.0
      PFL4=0.0
      DO 64 I=1,17
      PML3=RD3(I,1)*PI3(I,1)+PML3
      PFL3=RD3(I,2)*PI3(I,2)+PFL3
      PML4=RD4(I,1)*PI4(I,1)+PML4
 64   PFL4=RD4(I,2)*PI4(I,2)+PFL4
      PML3=PML3/(PML3+PFL3)
      PFL3=1.0-PML3
      PML4=PML4/(PML4+PFL4)
      PFL4=1.0-PML4
      XEMP3=PML3*EE1
      FEMP3=PFL3*EE1
      XEMP4=PML4*EE2
      FEMP4=PFL4*EE2
      DO 641 I=1,17
      EMP3(I,1)=XEMP3*RD3(I,1)
      EMP3(I,2)=FEMP3*RD3(I,2)
      EMP4(I,1)=XEMP4*RD4(I,1)
641   EMP4(I,2)=FEMP4*RD4(I,2)
 14   FORMAT (1H1,5A2,5X,58HRELATIVE DISTRIBUTION OF EMPLOYED
      WORKERS AMONG INDUSTRIES/34X,18HBY MALE AND FEMALE/27X,
      4HMALE,24X,6HFEMALE)
 15   FORMAT (1H0,16X,2(3X,4H1950,3X,4H1960,3X,4H1970,3X,4H1980))
 16   FORMAT (1H0,8A2)
 17    FORMAT (1H,8A2,8F7.3)
       PUNCH 14,NAME
       PUNCH 15
       DO 13 I=1,17
       PUNCH 16,(INDUS(I,J),J=1,8)
       PUNCH 17,(INDUS(I,J),J=9,16),RD1(I,1),RD2(I,1),RD3(I,1)RD4(I,1)
      1RD1(I,2),RD2(I,2),RD3(I,2),RD4(I,2)
 13    CONTINUE
 18    FORMAT (1H1,5A2,9X,42HRELATIVE DISTRIBUTION OF MALES AND
       FEMALES/3 16X,17 HWITHIN INDUSTRIES)
 19    FORMAT (1H,22X,4H1950,10X,4H1960,10X,4H1970,10X,4H1980)
210    FORMAT (1H,17X,4(2X,4HMALE,2X,6HFEMALE))
       PUNCH 18,NAME
       PUNCH 19
       PUNCH 210
       DO 211 I=1,17
       PUNCH 16,(INDUS(I,J),J=1,8)
       PUNCH 17,(INDUS(I,J),J=9,16),PI1,(I,1),PI1(I,2),PI2(I,1),
       PI2(I,2),PI3(I,1),PI3(I,2),PI4(I,1),PI4(I,2)
211    CONTINUE
 21    FORMAT (1H0,70HWEIGHTED AGGREGATE RELATIVE DISTRIBUTION
       OF EMPLOYED MALES AND FEMALES/23X,5HMALES,22X,7HFEMALES)
220    FORMAT (1H,12X,2(4H1950,3X,4H1960,3X,4H1970,3X,4H1980,3X))
 23    FORMAT (1H,9X,8F7.3)
       PUNCH 21
       PUNCH 220
       PUNCH 23,PML1,PML2,PML3,PML4,PFL1,PFL2,PFL3,PFL4
 24    FORMAT (1H1,5A2,8X,49HDISTRIBUTION OF EMPLOYED WORKERS
       AMONG INDUSTRIES/28X,5HMALES,24X,7HFEMALES)
25     FORMAT (1H,12X,2(6X,4H1960,6X,4H1970,6X,4H1980))
       PUNCH 24,NAME
       PUNCH 25
 26    FORMAT (1H,8A2,F8.0,5F10.0)
       DO 27 I=1,17
       PUNCH 16,(INDUS(I,J),J=1,8)
       PUNCH 26,(INDUS(I,J),J=9,16),EMP2(I,1),EMP3(I,1),EMP4(I,1),
       EMP2(I,2),EMP3(I,2),EMP4(I,2)
 27    CONTINUE
 28    FORMAT (1H0,5HTOTAL,9X,6F10.0)
       PUNCH 28,XEMP2,XEMP3,XEMP4,FEMP2,FEMP3,FEMP4
500    FORMAT (I2,I2,4F10.0,35X,1H9)
 11    FORMAT (I2,5A2,67X,1H9)
       PUNCH 11,ICTYNR,NAME
       DO 501 I=1,17
 501    PUNCH 500,ICTYNR,I,EMP3(I,1),EMP3(I,2),EMP4(I,1),EMP4(I,2)
 601    FORMAT (I2,I2,I1,4F10.0,33X,2H99)
        DO 602,I=1,17
        N=1
        PUNCH 601,ICTYNR,I,N,EMP1(I,1),EMP1(I,2),EMP2(I,1),EMP2(I,2)
        N=2
 602    PUNCH 601,ICTYNR,I,N,EMP3(I,1),EMP3(I,2),EMP4(I,1),EMP4(I,2)
        GO TO 20
 100    STOP
        END
 1AG.,FORESTRY, + FISHERIES
 2MINING
 3CONSTRUCTION
 4DURABLE MANUF.
 5NON-DURABLE    MANUF.
 6TRANS.,COM.,AND OTHER PUB. UTIL.
 7WHSLE. TRADE
 8FOOD AND DAIRY PRODS. STORES
 9EATING AND DRINK. PLACES
10OTHER RETAIL   TRADE
11FIN.,INS., AND REAL ESTATE
12BUSINESS AND REPAIR SERVICE
13PERSONAL SERVICE
14ENTERT. AND REC. SERVICES
15EDUCATIONAL SERVICES
16OTHER PROF. AND REL. SERVICES
17PUBLIC ADMIN.
```

The Occupational Projections Program

This program projects employment for each of nine occupational groups in each of 17 industrial groups. This program will show which occupations will become more important in the State should the trends of the 1950-1960 decade continue, and which industries will develop the strongest demands for labor in the State.

The projections developed by this program also show which industries will be the largest employers of particular occupational groups. The results of this program should assist planners in determining the future educational needs of their counties.

Steps 1-10 format statements.

Step 7 ends a loop which reads in a county digit of some kind followed by 18 industry names or digits.

Step 12 reads in the projected industrial occupation arrays where I=occupation groups, J=industry groups and K=sex (1 for males, 2 for females). Basically, these arrays are ratios applied to the 1950 and 1960 relative distributions by industry. Here, the arrays themselves, rather than data, are read in.

Step 220 ends a loop in which projected employment arrays by both sexes and 17 industrial groups are established. EMP3=1970 projected employment, EMP4=1980 projected employment.

Step 221 establishes an array for the projected occupational employment by sex and industry group. K=sex (1 for male, 2 for female, 3 for total), J represents the industry groups in which employment by occupational groups is projected (13 plus 14 for a total), and I=occupational groups (nine groups plus 10 for a total). OCC3=1970 projected occupations, OCC4=1980 projected occupations.

Step 13 initiates the actual reading of numerical data. The county number and name are read. If the county number=99, the program stops. A 99 card must be inserted behind the input data cards for this reason. The 99 will be punched in cc1-2. If the county number is not equal to 99, the program continues.

Step 131 initializes N. The projected 1970 and 1980 employment in each of 17 industry groups by sex (1=males, 2=females) is read in.

Step 141 starts a check series to determine if the card sequence is correct. If the county numbers are not sequential, the message ERROR IN COUNTY is typed and another county is read. If the county is in correct sequence, a determination of industry correct sequence is made. If the industry numbers are out of sequence (IND≠N), the message ERROR IN INDUSTRY is typed. In each case, the out of sequence county or industry numbers are typed. If all is well, the program continues.

Step 181 This step initiates the combination of the 17 industry groups derived from the industry projections program into 13 industry groups used in these occupational projections. This combination into a smaller number of groups was made necessary by the limited data available for employment of each occupation in each industry. The combination is as follows:

	Industry Projections Group	Occupational Projections Group
	1. Agriculture, Forestry and Fisheries	1. Agriculture, Forestry and Fisheries
	2. Mining	2. Mining
	3. Construction	3. Construction
	4. Durable Manufactures	4. Durable Manufactures
	5. Non-Durable Manufactures	5. Non-Durable Manufactures
	6. Transportation-Utilities	6. Transportation-Utilities
	7. Wholesale Trade	7. Trade
	8. Food Stores	
Step 19	9. Eating and Drinking Places	
	10. Other Retail Trade	
	11. Finance, Insurance, Real Estate	8. Finance, Insurance, Real Estate
	12. Business and Repair Services	9. Business and Repair Services

	Industry Projections Group		Occupational Projections Group
	13. Personal Services	→	10. Personal Services
Step 20	14. Entertainment and Recreation Services	→	11. Entertainment and Recreation Services
	15. Educational Services	→	
	16. Other Professional and Related Services	→	12. Professional Services
Step 200	17. Public Administration	→	13. Public Administration

Step 21 ends a loop which determines the projected 1970 and 1980 employment by occupation, industry and sex (K=sex, J=industry, I=occupational group). The projected sex-industry-occupational distribution of employment for 1970 (OCC3) and for 1980 (OCC4) is determined by multiplying the projected arrays (AOCC(3 or 4)) by projected employment by sex in each industry group.

Step 22 ends a loop which determines projected employment for 1970 and for 1980 in each of the nine occupational groups for each sex. Industry group 14 indicates total projected employment for each sex.

The nine occupational groups are listed below.

1. Professional, Technical and Kindred Workers

2. Managers

3. Clerical and Kindred Workers

4. Sales Workers

5. Craftsmen, Foremen and Kindred Workers

6. Operatives and Kindred Workers

7. Service Workers, Inc. Farm

8. Laborers

9. Occupation Not Reported

NOTE: The separation of farm and non-farm managers and laborers mentioned in the methodology did not appear in the program. It possibly occurred in the arrangement of the input data.

Column headings are punched.

The total projected employment in each occupational group is determined by summing the projected employment for males and for females in each occupational group. OCC (3 or 4) (3, 14, I) represent this total for 1970 and 1980, respectively. In the second parenthesis, 3=total for sex, 14=total for industry groups, I=occupational group.

The punching of the final output now begins.

Step 23 punches output that will be used to print results. The projected occupational employment by sex as a sum of all industry groups is punched. Total employment in each occupational group (I=occupational group) is also punched. Occupational Group 10; Industrial Group 4 are totals, 1 represents male employment, 2 represents female employment, 3 represents total employment.

Step 52 punches output in 9 cards that will be used as input to the occupational accumulations program. These are the projected 1970 and 1980 employment by males and by females for each occupational group. J=14 represents the industries.

This is the last step in the program. Another county will be read, and if the county number equals 99, the program stops.

The Computer Program for these projections follows:

```
      DIMENSION AOCC3(2,14,9),AOCC4(2,14,9)
      DIMENSION INDUS(14,16),OCC3(3,14,10),OCC4(3,14,10),NAME(5)
      DIMENSION EMP3(17,2),EMP4(17,2)
      DIMENSION OCC(9,18)
    1 FORMAT (I1,18A2)
    2 FORMAT (1H1,5A2,28X,22HOCCUPATION PROJECTIONS)
    3 FORMAT (1H,28X,5HMALES,14X,7HFEMALES,14X,5HTOTAL)
    4 FORMAT (1H,18X,3(6X,4H1970,6X,4H1980))
    5 FORMAT (1H,9A2)
    6 FORMAT (1H,9A2,6F10.0)
    9 FORMAT (I2,5A2)
   10 FORMAT (I2,I2,4F10.0)
      DO 7 I=1,9
    7 READ 1,XCCNR,(OCC(I,J),J=1,18)
   12 FORMAT (16F5.3)
      READ 12,(((AOCC3(K,J,I),I=1,9),J=1,14),K=1,2)
      READ 12,(((AOCC4(K,J,I),I=1,9),J=1,14),K=1,2)
      DO 220 K=1,2
      DO 220 I=1,17
      EMP3(I,K)=0.0
  220 EMP4(I,K)=0.0
      DO 221 K=1,3
      DO 221 J=1,14
      DO 221 I=1,10
      OCC3(K,J,I)=0.0
  221 OCC4(K,J,I)=0.0
   13 READ 9,ICTYNR,NAME
      IF(ICTYNR-99)131,100,131
  131 N=0
      DO 14 I=1,17
      READ 10,ICTNR1,IND,EMP3(I,1),EMP3(I,2),EMP4(I,1),EMP4(I,2)
      N=N+1
      IF(ICTYNR-ICTNR1)17,141,17
  141 IF(IND-N)18,14,18
   14 CONTINUE
      GO TO 181
   15 FORMAT (15HERROR IN COUNTY,I2,I2)
   16 FORMAT (17HERROR IN INDUSTRY,I2,I2,I2)
   17 TYPE 15,ICTYNR,ICTNR1
      PAUSE
      GO TO 13
   18 TYPE 16,ICTYNR,IND,N
      PAUSE
      GO TO 13
  181 DO 19 K=1,2
      DO 19 I=8,10
      EMP3(7,K)=EMP3(I,K)+EMP3(7,K)
   19 EMP4(7,K)=EMP4(I,K)+EMP4(7,K)
      DO 20 K=1,2
      DO 20 I=8,11
      EMP3(I,K)=EMP3(I+3,K)
   20 EMP4(I,K)=EMP4(I+3,K)
      DO 200 K=1,2
      EMP3(12,K)=EMP3(15,K)+EMP3(16,K)
      EMP4(12,K)=EMP4(15,K)+EMP4(16,K)
      EMP3(13,K)=EMP3(17,K)
```

```
200   EMP4(13,K)=EMP4(17,K)
      DO 21 K=1,2
      DO 21 J=1,13
      DO 21 I=1,9
      OCC3(K,J,I)=AOCC3(K,J,I)*EMP3(J,K)
 21   OCC4(K,J,I)=AOCC4(K,J,I)*EMP4(J,K)
      DO 22 K=1,2
      DO 22 I=1,9
      DO 22 J=1,13
      OCC3(K,14,I)=OCC3(K,J,I)+OCC3(K,14,I)
 22   OCC4(K,14,I)=OCC4(K,J,I)+OCC4(K,14,I)
      PUNCH 2,NAME
      PUNCH 3
      PUNCH 4
      DO 23 I=1,9
      OCC3(3,14,I)=OCC3(1,14,I)+OCC3(2,14,I)
      OCC4(3,14,I)=OCC4(1,14,I)+OCC4(2,14,I)
      PUNCH 5, (OCC(I,J),J=1,9)
 23   PUNCH 6,(OCC(I,J),J=10,18),OCC3(1,14,I),OCC4(1,14,I),OCC3(2,14,I),
     1OCC4(2,14,I),OCC3(3,14,I),OCC4(3,14,I)
 51   FORMAT (I2,I1,4F12.0,28X,1H9)
      DO 52 I=1,9
 52   PUNCH 51,ICTYNR,I,OCC3(1,14,I),OCC4(1,14,I),OCC3(2,14,I)OCC4(2,
     114,I)
      GO TO 13
100   STOP
      END
```

The Occupational Accumulation Program

This program accumulates the projected occupational employment by sex for 1970 and 1980 and provides totals for the state. It can search out a smaller group of counties within the state and accumulate the projected totals for this group.

Steps 1 through 6 are format statements.

Step 200 ends a loop which establishes the concept TOCC which stands for total occupations. K denotes years (1=1970; 2=1980); J represents sex (1=males, 2=females, 3=total), and I denotes occupational groups. IND is defined as equal to zero.

Step 8 ends a loop which reads in the county number (XCCNO) and the projected occupational employment for each of the 18 industry groups (including Industry Not Reported). J means industry group.

The statement READ 2, (LIST (I), I=1,N) is a statement providing for the search function in order to obtain projected employment for a subregion. A card is placed in front of the input deck telling the machine how many counties are to be processed and the numbers of those counties. The machine then reads each county number as the entire input deck is run through the machine. Only those counties whose numbers are punched in the card are actually processed by the program.

Steps 14 and 9 comprise a loop which reads in the county number (ICTYNR) and the projected 1970 and 1980 employment by sex for each of the nine occupational groups.

OCC3(1, 14, I)=1970 projected male employment in occupation I
OCC4(1, 14, I)=1980 projected male employment in occupation I
OCC3(2, 14, I)=1970 projected female employment in occupation I
OCC4(2, 14, I)=1980 projected female employment in occupation I

A test to see if all counties have been read is made. If the county number equals 99 (A 99 card is placed behind the input data cards.) the program punches output. If it is not equal to 99, the program continues with calculations.

Step 25 continues the program.
Another test to determine whether all counties have been read is made at this point. This loop is especially applicable to search operations where the accumulation for a subregion is taken. If N≠96, compilation of totals begins. If N=96, Steps 10 and 12 perform another test.

Steps 10 and 12 are a loop that determines whether all the counties in a multi-county region have been read. If (ICTYNR=LIST (I)) then accumulation begins. If not, more data are read in.

Steps 11 and 15 comprise a loop that accumulates the projected industrial totals for males and for females for 1970 and 1980. J means sex; I means occupational group. (TOCC(1 or 2) J, I) means total projected employment in 1970 or 1980 by sex and occupational group.

Step 16 ends a loop which adds together the projected employment by sex, year and occupation. K means year; (1=1970, 2=1980). I means occupational group. The center number means sex (1=males, 2=females, 3=total). IND is identified. A series of tests are performed to see if the last county has been read. If N is not equal to 96, the program then checks to see if IND=N. If N=96, there is a check to see if IND=95. If IND≠95, the program returns to read more cards. If IND≠N, more cards are read. If IND=95, or if IND=N, the program proceeds with the punching of data.

Steps 19 and 20 comprise a loop which punches the output data. First the headings are punched. Then the projected employment by occupation (9) in each industry group (18) is punched, probably for males, for females and as a total. This is the final step in the program.

The Computer Program for these projections follows:

```
CPROGRAM TO ACCUMULATE 1970 AND 1980 OCCUPATIONAL PROJECTIONS
      DIMENSION OCC(9,18),OCC3(2,14,10),OCC4(2,14,10)
      DIMENSION LIST (96),TOCC(2,3,9)
    1 FORMAT (I1,18A2)
    2 FORMAT (4012)
    3 FORMAT (I2,1X,4F12.0)
    4 FORMAT (1H1,4X,5HSTATE,33X,13HPROJECTION OF,24X/29X
      31HEMPLOYED PE
     1RSONS BY OCCUPATIONS/27X,4HMALE,15X,6HFEMALE,14X,
      5HTOTAL)
    7 FORMAT (1H,15X,3(6X,4H1970,6X,4H1980))
    5 FORMAT (1H,9A2)
    6 FORMAT (1H,9A2,6F10.0)
      DO 200 K=1,2
      DO 200 J=1,3
      DO 200 I=1,9
  200 TOCC(K,J,I)=0.0
      IND=0
      DO 8 I=1,9
    8 READ 1,XCCNO, (OCC(I,J),J=1,18)
      READ 2,N,(LIST(I),I=1,N)
   14 DO 9 I=1,9
    9 READ 3,ICTYNR,OCC3(1,14,I),OCC4(1,14,I),OCC3(2,14,I),
      OCC4(2,14,I)
      IF (ICTYNR-99)25,19,25
   25 CONTINUE
      IF(N-96)10,11,10
   10 DO 13 I=1,N
   12 IF(ICTYNR-LIST(I))13,11,13
   13 CONTINUE
      GO TO 14
   11 DO 15 J=1,2
      DO 15 I=1,9
      TOCC(1,J,I)=OCC3(J,14,I)+TOCC(1,J,I)
   15 TOCC(2,J,I)=OCC4(J,14,I)+TOCC(2,J,I)
      DO 16 K=1,2
      DO 16 I=1,9
   16 TOCC(K,3,I)=TOCC(K,1,I)+TOCC(K,2,I)
      IND=IND+1
      IF(N-96)18,17,18
   17 IF(IND-95)14,19,14
   18 IF(IND-N)14,19,14
   19 CONTINUE
      PUNCH 4
      PUNCH 7
      DO 20 I=1,9
   PUNCH 5, (OCC(I,J),J=1,9)
20 PUNCH 6, (OCC(I,J),J=10,18),TOCC(1,1,I),TOCC(2,1,I),TOCC(1,
  12,I),TOCC(2,2,I),TOCC(1,3,I),TOCC(2,3,I)
   STOP
   END
```

The Industrial Accumulation Program

This program accumulates the projected employment by sex for 1970 and 1980 for each of the computer industry groups processed in other programs. It can search out a smaller group of counties within the State and accumulate the projected totals for this group.

The input for this program comes from the industrial projections program. It produces printed output only.

Steps 1-40 are format statements.

The next section reserves dimension storage space for employment figures, percentages of total employed represented by each sex group, and relative distribution of total employment among industries.

Step 401 ends a loop which initializes total employment figures by industry and sex.

J represents the two sexes plus total employment, I represents the 17 industry groups plus a total figure. (EMP5) represents 1950 employment, (EMP6) represents 1960 employment, (EMP7) represents 1970 projected employment, and (EMP8) represents 1980 projected employment.

Step 41 begins the reading of input data. The industry number is read in, along with J, which is some type of order sequencer.

Then (LIST(I)) is read. In the case of a multi-county region smaller than the State, the number of counties in the region and the county with the highest number included in the region are read in. The computer is told how many and what counties are to be processed.

Steps 6 and 61 are a loop which reads in the county number and the actual or projected employment for 1950, 1960, 1970 and 1980 by sex and industry group.

(I) represents one of the 17 industry groups. 1=male employment, 2=female employment. (EMP1) represents 1950 employment, (EMP2) represents 1960 employment, (EMP3) represents projected 1970 employment, (EMP4) represents projected 1980 employment. EXAMPLES: (EMP1(I,2)) represents 1950 female employment in industry group I. (EMP4(I, 1)) represents 1980 male employment in industry group I.

A test is made here to see (if accumulation for the State is desired) if the last county has been read. A card with a 96 punched in it is inserted behind the input deck to insure completion of the program. If there are more counties in some other State, the program can easily be altered to accommodate a larger number of counties. If the 96 card is not read at this point, a test is made to see if the last county of a multi-county region has been read. If the 96 card or the last county in a region is read, the program proceeds to the computation of final output data.

Step 5 performs a test to see if the last county of a multi-county region has been read. If it has not been read (if ICTYNR≠ LIST(I)), the program returns to Step 6 to read the employment for the next county. If the last county has been read (if ICTYNR=LIST(I)), the computation of the output data begins with Step 8.

Steps 8 and 9 are a loop which converts the actual and projected employment by sex and industry group for each census year from (EMP (1 through 4)) to (EMP (5 through 8)). An example is 1960 employment, which is changed from (EMP2) to (EMP6). J=sex, I=industry groups. (EMP5)= 1950 employment, (EMP6)=1960 employment, (EMP7)=1970 employment, (EMP8)=1980 employment. These figures and this loop derive total employment.

(IND) is initialized. It is increased by one for each county read. The first test is made to see if the number of counties in the region equal 96 (this is, an accumulation for the whole State is being read). If it is, Step 36 tests to see if IND=95. If it is not, Step 35 tests to see if the last county in a subregion has been read. It should be emphasized that Step 36 is used only when an accumulation for the entire State is desired, and Step 35 is used whenever an accumulation for a region smaller than the State is being taken. If the last county for the State or for a subregion has been read, Step 37 leads to the computation for output data. If the last county has not been read, Step 6 reads in the next county.

Step 10 ends a loop which obtains total actual or projected employment by sex (represented by J) by summing employment in each of the 17 industry groups (represented by I) for a total employment figure for each sex for each of the four Census years, 1950 through 1980. This total figure is represented by EMP (5 through 8 for the census years) (18 (denoting total), J).

Step 11 ends the loop which computes the relative distribution of employment of males and of females among industries. RD (5,6,7,8) represents 1950, 1960, 1970 and 1980 distributions, respectively. Employment in ^{I}th industry and ^{J}th sex is divided by employment in ^{J}th sex for that year.

Step 12 ends a loop which computes total employment for each of the four Census years by adding total male employment and total female employment. EMP (5 through 8) (I)3=EMP (5 through 8) (I)1+EMP (5 through 8) (I)2, with (5 through 8) representing the Census years and (I) meaning the ^{I}th industry group.

Step 13 ends a loop which determines the relative distribution of males and females within industries for the four Census years. (PI(5 through 8)) (I,J) represents this percentage for one of these years for the ^{J}th sex in the ^{I}th industry. The actual punching of the final output begins. Several steps listed in the program are format statements which are explained in the computer program. Only those steps which actually punch output will be explained.

Step 18 punches the relative distribution of employment by males and by females among industry groups.

Step 210 punches the relative distribution of male and female employment within industries.

Step 24 begins the loop which punches the weighted aggregate distribution of employment of males and females in total employment for the four Census years.

Step 31 punches the total employment (in absolute numbers) for employed males and for employed females, for each industry group. Two output cards are punched for each county, one for industry groups 1-8, the other for 9-16. Then total employment figures (EMP(I)18), with I=5,8 and representing the four Census years are punched.

Step 34 ends a loop in which the absolute employment by industry group is punched. Again, two output cards are punched for each county in order to accomodate the number of industry groups.

The last step in the program punches total employment figures for each of the four Census years.

The Computer Program for these projections follows:

```
CPROGRAM TO ACC. TOTALS FOR STATE FOR EMPLOYMENT BY INDUSTRY
      1 FORMAT (I2,16A2)
      2 FORMAT (I2,3X,4F10.0)
      3 FORMAT (40I2)
      4 FORMAT (I2,I1,I2,16A2,3F10.0)
     40 FORMAT (I2,16A2)
        DIMENSION EMP1(17,2),EMP2(17,2),EMP3(17,2),EMP4(17,2),
        EMP7(18,3)
        DIMENSION PI1(17,2),PI2(17,2),PI3(17,2),PI4(17,2),
        INDUS(17,16)
        DIMENSION RD1(17,2),RD2(17,2),RD3(17,2),RD4(17,2)
        DIMENSION RD5(17,2),RD6(17,2),RD7(17,2),RD8(17,2)
        DIMENSION PI5(18,2),PI6(18,2),PI7(18,2),PI8(18,2)
        DIMENSION LIST (96),EMP5(18,3),EMP6(18,3),EMP8(18,3)
        IND=0
        DO 401 J=1,3
        DO 401 I=1,18
        EMP5(I,J)=0.0
        EMP6(I,J)=0.0
        EMP7(I,J)=0.0
    401 EMP8(I,J)=0.0
        DO 41 I=1,17
     41 READ 40,INDNR,(INDUS(I,J),J=1,16)
        READ 3,N,(LIST(I),I=1,N)
      6 DO 61 I=1,17
        READ 2,ICTYNR,EMP1(I,1),EMP(I,2),EMP2(I,1),EMP2(I,2)
     61 READ 2,ICTYNR,EMP3(I,1),EMP3(I,2),EMP4(I,1),EMP4(I,2)
        IF(LIST(1 )-96)5,8,5
      5 DO 7 I=1,N
        IF(ICTYNR-LIST(I))7,8,7
      7 CONTINUE
        GO TO 6
      8 DO 9 J=1,2
        DO 9 I=1,17
        EMP5(I,J)=EMP1(I,J)+EMP5(I,J)
        EMP6(I,J)=EMP2(I,J)+EMP6(I,J)
      EMP7(I,J)=EMP3(I,J)+EMP7(I,J)
 9    EMP8(I,J)=EMP4(I,J)+EMP8(I,J)
      IND=IND+1
      IF(LIST(1)-96)35,36,35
36    IF(IND-95)6,37,6
35    IF(IND-N)6,37,6
37    CONTINUE
      DO 10 J=1,2
      DO 10 I=1,17
      EMP5(18,J)=EMP5(I,J)+EMP5(18,J)
      EMP6(18,J)=EMP6(I,J)+EMP6(18,J)
      EMP7(18,J)=EMP7(I,J)+EMP7(18,J)
10    EMP8(18,J)=EMP8(I,J)+EMP8(18,J)
      DO 11 J=1,2
      DO 11 I=1,17
      RD5(I,J)=EMP5(I,J)/EMP5(18,J)
      RD6(I,J)=EMP6(I,J)/EMP6(18,J)
      RD7(I,J)=EMP7(I,J)/EMP7(18,J)
11    RD8(I,J)=EMP8(I,J)/EMP8(18,J)
      DO 12 I=1,18
      EMP5(I,3)=EMP5(I,1)+EMP5(I,2)
      EMP6(I,3)=EMP6(I,1)+EMP6(I,2)
      EMP7(I,3)=EMP7(I,1)+EMP7(I,2)
12    EMP8(I,3)=EMP8(I,1)+EMP8(I,2)
      DO 13 J=1,2
      DO 13 I=1,18
      PI5(I,J)=EMP5(I,J)/EMP5(I,3)
      PI6(I,J)=EMP6(I,J)/EMP6(I,3)
      PI7(I,J)=EMP7(I,J)/EMP7(I,3)
13    PI8(I,J)=EMP8(I,J)/EMP8(I,3)
14    FORMAT (1H1,5HSTATE,10X,58HRELATIVE DISTRIBUTION OF
      EMPLOYED WORKE
     1RS AMONG INDUSTRIES/34X,18HBY MALE AND FEMALE/27X,
      4HMALE,24X,6HFEM
     2ALE)
15    FORMAT (1H0,16X,2(3X,4H1950,3X,4H1960,3X,4H1970,3X,
      4H1980))
16    FORMAT (1H0,8A2)
17    FORMAT (1H ,8A2,8F7.3)
      PUNCH 14
      PUNCH 15
      DO 18 I=1,17
      PUNCH 16,(INDUS(I,J),J=1,8)
 18  PUNCH 17,(INDUS(I,J),J=9,16),RD5(I,1),RD6(I,1),RD7(I,1),
    1RD8(I,1),RD5(I,2),RD6(I,2),RD7(I,2),RD8(I,2)
 19  FORMAT (1H1,5HSTATE,14X,42HRELATIVE DISTRIBUTION OF MALES
     AND FEMA
    1LES/36X,17HWITHIN INDUSTRIES)
 20  FORMAT (1H ,22X,4H1950,10X,4H1960,10X,4H1970,10X,4H1980)
 21  FORMAT (1H ,17X,4(2X,4HMALE,2X,6HFEMALE))
     PUNCH 19
     PUNCH 20
     PUNCH 21
     DO 210 I=1,17
     PUNCH 16,(INDUS(I,J),J=1,8)
210  PUNCH 17,(INDUS(I,J),J=9,16),PI5(I,1),PI5(I,2),PI6(I,1),
    1PI6(I,2),PI7(I,1),PI7(I,2),PI8(I,1),PI8(I,2)
 22  FORMAT (1H0,70HWEIGHTED AGGREGATE RELATIVE DISTRIBUTION
     OF EMPLOYE
    1D MALES AND FEMALES/23X,5HMALES,22X,7HFEMALES)
 23  FORMAT (1H ,12X,2(4H1950,3X,4H1960,3X,4H1970,3X,4H1980,
     3X))
 24  FORMAT (1H, 9X,8F7.3)
     PUNCH 22
     PUNCH 23
     PUNCH 24,PI5(18,1),PI6(18,1),PI7(18,1),PI8(18,1),PI5(18,
    12),PI6(18,2),PI7(18,2),PI8(18,2)
 25  FORMAT (1H1,5HSTATE,18X,39HINDUSTRY DISTRIBUTION OF
     EMPLOYED MALES
    1)
 26  FORMAT (1H1,5HSTATE,18X,41HINDUSTRY DISTRIBUTION OF
     EMPLOYED FEMAL
    1ES)
 27  FORMAT (1H ,25X,(4H1950,6X,4H1960,6X,4H1970,6X,4H1980))
 28  FORMAT (1H0,8A2)
 29  FORMAT (1H ,8A2,5X,4F10.0)
 30  FORMAT (1H ,5HTOTAL,16X,4F10.0)
     PUNCH 25
     PUNCH 27
     DO 31 I=1,17
     PUNCH 28,(INDUS(I,J),J=1,8)
 31  PUNCH 29,(INDUS(I,J),J=9,16),EMP5(I,1),EMP6(I,1),EMP7(I,1),
     EMP8(I,1)
     PUNCH 30,EMP5(18,1),EMP6(18,1),EMP7(18,1),EMP8(18,1)
     PUNCH 26
     PUNCH 27
     DO 32 I=1,17
     PUNCH 28,(INDUS(I,J),J=1,8)
```

```
32  PUNCH 29,(INDUS(I,J),J=9,16),EMP5(I,2),EMP6(I,2),EMP7(I,
     2),EMP8(I,2)
    PUNCH 30,EMP5(18,2),EMP6(18,2),EMP7(18,2),EMP8(18,2)
33  FORMAT (1H1,5HSTATE,18X,39HINDUSTRY DISTRIBUTION OF
    TOTAL EMPLOYED
   1)
    PUNCH 33
    PUNCH 27
    DO 34 I=1,17
    PUNCH 28,(INDUS(I,J),J=1,8)
34  PUNCH 29,(INDUS(I,J),J=9,16),EMP5(I,3),EMP6(I,3),EMP7(I,3),
    EMP8(I,
   13)
    PUNCH 30,EMP5(18,3),EMP6(18,3),EMP7(18,3),EMP8(18,3)
    STOP
    END
```